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Europe/Latin America Report

SCIENCE AND TECHNOLOGY

ITALY: NATIONAL SPACE PLAN 1987-1991

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ITALY: NATIONAL SPACE PLAN 1987-1991

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[Text] I Foreword

The report on the revision of the 1987-91 National Space Plan (NSP) is divided into the following two sections:

--The first section consists of an economic overview dealing with the work done since 1980 and an outline of the proposed revision;

--The second section consists of a detailed description of the economic and technical aspects of the programs.

The report is accompanied by the following attachments:

1) General description of the contracts stipulated as part of the plan in the period 1980-86, broken down according to companies and areas of intervention;

2) Decisions of CIPE (Interministerial Committee for Economic Planning) concerning the creation of the NSP and earlier revisions of this plan;

3) Documentation of the international collaboration agreements covering the programs in the plan.

II. Introduction

In Italy, the scientific and industrial sectors play an important role in space activity. The way in which this activity is developed is similar to the method used in the other leading European nations, through participation in the work of ESA (European Space Agency) and implementation of the various NSP programs.

The NSP has now reached its third revision, for the 5-year period 1987-1991. This plan was initially formulated by scientists and industry. It was then adopted by the Minister for Research and presented, receiving approval from CIPE in December 1979. The objective of this plan was to promote:

--Development of a technological sector of strategic importance;
--The systems capabilities of the Italian space sector;
--Scientific programs dealing with both pure and applied research that would stimulate the design and production capabilities of Italian industry.

The NSP, therefore, constitutes an important experiment in industrial promotion in a sector which is regarded as strategic both for its direct applications and for the technological spin-offs in a number of fields such as mechanical engineering, electronics, new materials, data processing, and automation.

The work of the plan, which is completely funded with public money, is organized into programs for the construction of specific space units which represent the leading edge of today's technological capabilities at an international level and are fully competitive with the work in progress in other countries of the world.

Overall responsibility for each program is entrusted to one of the leading national industries. As far as is possible and financially viable in terms of future market prospects, construction of the various subsystems is also entrusted to specialist domestic companies.

1. Summary of the Work Completed Under the Preceding Revisions

From the time the plan was created, the choice of the programs to be included has been in line with the state of the art as it emerged at world level. This selection was also intended to satisfy national requirements for new and improved services in areas such as telecommunications and earth surveying, with the aim either of helping Italy to penetrate the new and promising markets opening up in space activity in areas such as propulsion systems and large structures, or of satisfying the requirements of the scientific community by providing satellites for studying the physics of the universe and the planet Earth.

This produced a well balanced program which is being developed on the basis of periodic reviews and with a well organized contribution on the part of industry and the most prominent representatives of scientific and technological research in Italy.

From the time of its formulation, the NSP defined the main areas of intervention, proposing not only the construction of a space-based telecommunications system and an auxiliary launching system for the space shuttle, but also the development of a program in the sector of large space-based structures as part of the orbiting space stations of the future.

Emphasis was also placed on earth surveying and pure research and technological research. A program was set up for the creation of a scientific satellite which would, if possible, be constructed with the collaboration of other European nations.

The first revision of the NSP took place in 1982. With this revision, CIPE approved the proposal for the Italsat satellite for the national telecommunications system, as well as the IRIS launching system to be used as an auxiliary launcher in association with the American space shuttle and, finally, the collaborative program with NASA on advanced structures, a program which was to consist of the construction of a "tethered" satellite system.

In addition, the new revised plan provided for better organization of both the funding of pure research and technological research, and of the program for earth surveying, approving a pilot program for the latter which would develop new products for operational applications in space, with the coordinated contribution of the research capabilities of Italian universities and the CNR [National Research Council].

Under the 1982 NSP revision, approval was also given to the principle that Italian investment in the activity of ESA should basically be in line with the amounts invested by the country in the NSP.

The second revision of the plan was approved by CIPE in 1984. This revision made it possible for CIPE to evaluate more accurately the cost of the main programs for which the preliminary design phases had been completed (Italsat and IRIS), giving an assessment which was, on the whole, definitive.

CIPE also gave its approval for the construction of a geodetic satellite (Lageos) which would be launched, as the first load for testing of the IRIS, in a scientific program implemented in collaboration with NASA. CIPE also approved the construction of the SAX scientific satellite for X-ray astronomy. At this time, a collaborative program was being formulated for this satellite with the Netherlands authority, NIVR [Netherlands Space Agency], and a number of research institutes in the Netherlands.

It was felt to be more appropriate to divide the research work needed into pure research and technological research. A program of space geodesy was also passed. This program, which was to be implemented in collaboration with NASA, included the setting-up of the geodetic laser station at Matera, Italy (with the contribution of the regional authorities of Basilicata) and the start-up of programs for producing instruments for mobile laser systems and for a dedicated VLBI [Very Long Baseline Interferometer] system.

In the sector of earth surveying, programs were established for the construction of specialized systems for the acquisition and processing of data and images. Here again, these programs were implemented with close collaboration between universities and industry.

The need to bring investment in ESA programs into line with investment in domestic programs was confirmed, since development of the latter would produce benefits for Italian industry that would make it possible for this sector to consolidate its position at an international level.

Therefore, this mechanism of periodic revision of the plan by CIPE proved to be of great importance since it created the bases for a flexible procedure which permitted extremely complex programs to develop fully, proposing the financing necessary for the various program phases on the basis of precise evaluations based on systems studies, preliminary design phases and phases involving lengthy, problematic negotiations for the awarding of the contracts for the necessary production work.

For these reasons, the organizational model which was thus implemented must represent an important reference point both for the creation of

the new management structures that have been urgently required for some time now, as well as for the overcoming of bureaucratic constraints and delays which are not compatible with the dynamic nature of a competitive industry such as the space sector.

With regard to management aspects, we should also emphasize that, while still complying with present regulations pertaining to government bodies and with the heavy constraints imposed by the law on state control, the organization which as been implemented by the CNR for management of the NSP until such time as adequate structures are created has been able to test methods of technical and scientific management of important programs using totally dedicated specialist personnel. Obviously, this has been done by creating a clear distinction between, on the one hand, planning and control activity and, on the other hand, program execution entrusted to industry, research centers, institutes forming part of the CNR and, finally, universities.

2. Economic Overview of the Period 1980-86, With Reference to the Cost Schedule, Breakdown by Programs and Breakdown by Companies Involved

We feel that it would be useful to group together certain financial data characterizing the activity of the NSP. These figures refer to the period 1980-86, since the NSP approved by CIPE at the end of 1979 took effect in 1980.

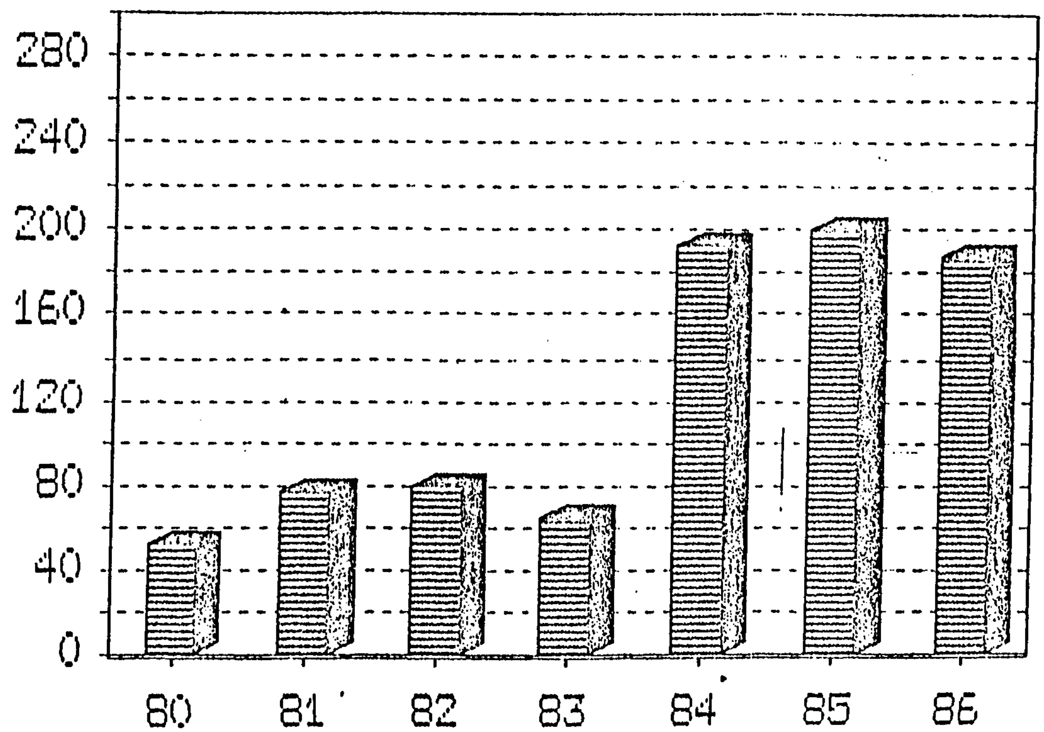
The table in figure 1 represents a histograph of the financing approved in the period 1980-86. It can be seen that the amounts increased from 1984 onward, since 1984 was the year in which production of the main programs started.

The table in figure 2 gives a breakdown of the costs by areas of intervention (1980-86).

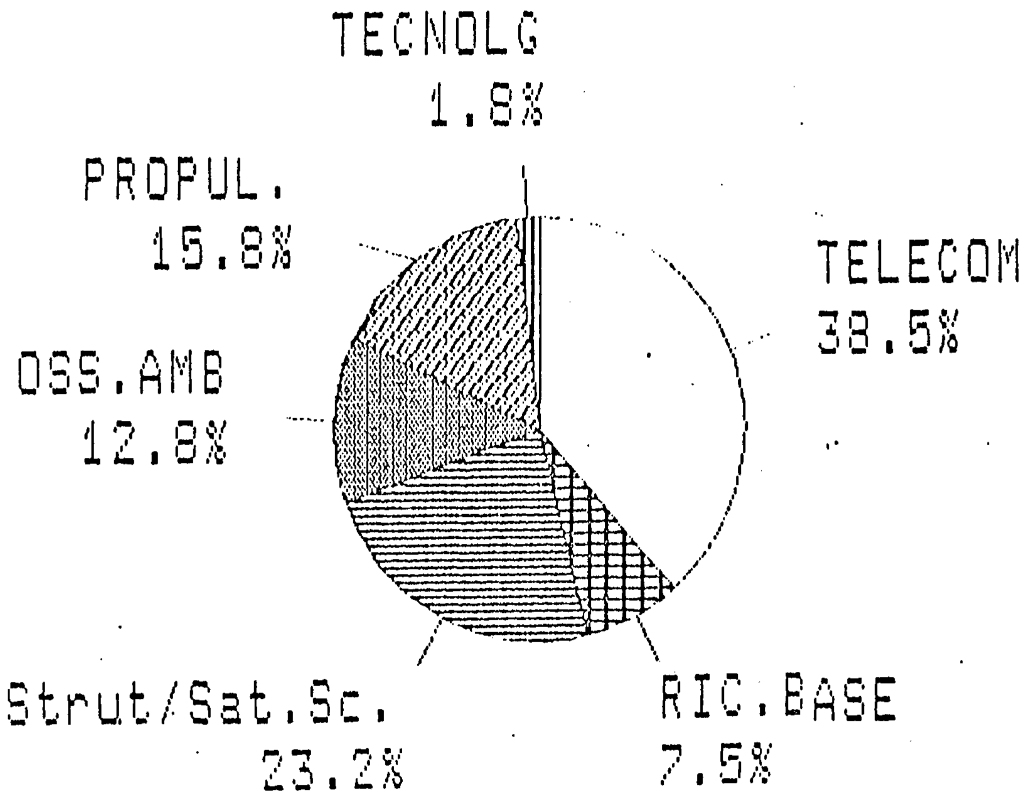
Figure 3 gives a breakdown of the orders in the period 1980-86 according to the sectors to which these orders were awarded (companies, universities, CNR institutes).

In order to be able to evaluate the tables in figures 2 and 3 accurately, however, it must be pointed out that the orders for 1986 refer to the contracts stipulated in the first half of the year only.

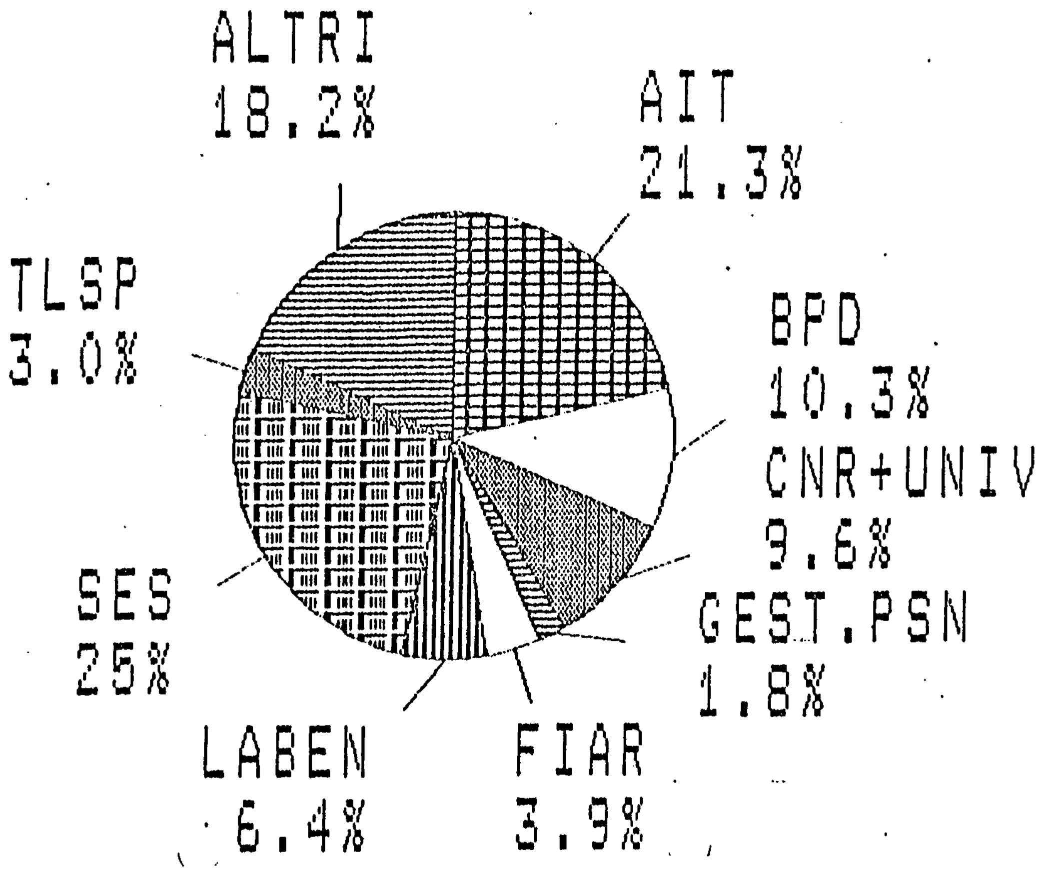
National Space Plan
Financing 1980 - 1986



Distribution of contracts according to sector
1980 - 1986



Distribution of contracts according to contractor
1980 - 1986



As analysis of these tables confirms that the NSP was developed in conformity with the principles on which the original plan was based. The role of industrial promotion played by the NSP emerges clearly, as does the special importance placed on the laboratory work conducted by the universities and the CNR, of fundamental importance for development of the basic areas.

The sectorial breakdown highlights the fact that, in line with the policy originally established, the NSP promotes balanced intervention both in sectors that are more mature commercially, such as telecommunications and remote surveying, and in leading edge sectors such as space transportation systems and the construction of space stations.

Activity is divided between a vast number of sectors of industry. In conformity with the planning principles established in 1979, the NSP places very great emphasis on systems activity, with the objective of improving the standing of Italian industry in the international context.

3. Frame of Reference Regarding Space Activity at World Level

The proposed revision of the 5-year plan has to take into account a framework of world activity that is in rapid evolution.

Certain services based on space technologies have been commercially viable for some years now. Examples of these are services in telecommunications systems, direct television broadcasting, and communication using mobile systems.

But it is not only the telecommunications sector, a sector which today interests both highly developed countries and developing nations alike, which is being developed at a commercial level. Other sectors such as earth surveying, with applications in meteorology, agriculture, oceanography, and control of the environment also are rapidly reaching the stage at which they can be applied. In recent years, in fact, developments in space stations and new launching systems lead us to expect new methods of developing space-based structures using inhabitable orbiting infrastructures capable of providing services for the launching, maintenance, and recovery of satellites. These infrastructures would be fitted with laboratories for studying and developing new materials in gravity-free conditions and would make it possible to construct large structures in space for scientific purposes and for scientific applications. Over the last 20 years, the space technology acquired by various countries has made highly sophisticated undertakings possible and today this, in turn, gives thrust to the leading edge sectors of electronics, robotics, sensors and optics. It

is also leading to the formulation of new standards of organization and control which are beneficial to industry, including those sectors of industry which have no direct connection with space activity.

The substantial amounts invested by the United States and the Soviet Union in space activity makes these two nations the undisputed leaders in the commercial application of space services and products.

It must be remembered, however, that Europe and Japan are doing a great deal of work in this sector in order to create a position for themselves in tomorrow's markets in telecommunications, earth surveying, and new materials which can be produced only in the gravity-free conditions of space. Moreover, Japan and Europe already have their own launching capabilities and are developing programs for the construction of orbiting infrastructures.

Other countries such as China and India are also making substantial efforts in the same direction.

The picture that emerges is one of overall confirmation of the rapid evolution of space activity, a trend which was already evident in previous years, even though it is possible that the recent tragedy of the shuttle may have negative repercussions for NASA and space agencies working in collaboration with NASA regarding the timing of planned missions.

To turn to the financial aspect, the United States spends about $15 billion annually on space activity. Of this total, $7 billion is allocated to NASA programs, whereas $8 billion is spent on DOD [Department of Defense] programs. The cost of developing the initial version of the space station was an estimated $8 billion. This figure must be compared to the $70 billion spent on the Apollo program and the $15 billion spent on developing the shuttle.

It is estimated that, in the period 1995-2000, more than $50 billion will be spent annually in the United States on the development of commercial activity related to space activity. Private sector investment in the space sector in the United States is increasing rapidly, growing from the 1980 figure of approximately $10 million to $175 million in 1983, with a projection of about $1 billion in 1987.

In parallel with the United States, the Soviet Union is developing major programs of scientific research and interplanetary exploration, as well as programs for the application of telecommunications and surveying of the earth's environment. The USSR is also working on the development of recoverable transportation systems and orbiting space stations. The estimated total annual investment is approximately $20 billion.

Japan is developing extremely ambitious space programs, placing special emphasis on the construction of the space station in collaboration with the United States. In 1984, Japan spent approximately $500 million on space activity.

Turning now to the situation in Europe, it must be mentioned that the ESA has an annual budget of approximately 950 million ECUs [European Accounting Units]. If we add to this figure the sums spent on national programs by European countries, which amount to a total of about 750 million ECUs, this means that annual expenditures in Europe is about 1.7 billion ECUs, equal to about one-tenth of the amount spent each year by the United States.

Still in Europe, the estimated cost of producing the Columbus is about 2600 MUC [Million Unites de Compte: 1 million units of account--standard monetary units accepted by the European Monetary System] equal to about one-quarter of the amount spent by the United States for the space station.

It is estimated that ESA will spend an additional 2600 MUC for the Ariane 5, whereas the estimated cost to France of the Hermes (a shuttle-type recoverable launcher) is approximately 1200 MUC.

Italy's average contribution to ESA is 12.6 percent (1984). This means that if Italy wants to keep abreast of the major European countries and to become increasingly competitive at an international level, particularly in industrial terms, the country will have to maintain its development of space activity at a level which is in line with the projected levels of expenditure in these other European countries.

4. Proposed Revision and Global Technical and Economic Analysis

The third revision of the NSP, for the period 1987-91, takes into account developments in international space activity and is fully in line with the long-term planning initiated in 1979 and which has already been revised twice by CIPE.

The 1987-91 revision, together with the re-evaluation of the activity for the year in progress, is divided into three sections.

The first section deals mainly with programs that are at an advanced stage of implementation and will be ready for launching before the end of this decade, assuming that there are no changes caused by external factors such as the delays in the shuttle launching schedule. This section also covers programs that have already been approved but whose

design phase has not been completed and which are scheduled for launching after 1990. The section deals with programs with an annual activity based on a specific budget. Finally, this first section covers the operational activities of management and control, as shown in the tables on the following pages.

The second section deals with the logical extensions of programs now in progress, or the development of designs based on feasibility studies that have already been conducted and that have shown that the scientific and technological aspects are compatible with industrial requirements. This section also covers programs which represent the logical progression of work which is already being conducted as part of international collaborative programs.

The proposed areas of development are the following:

--Subsequent "tethered" missions and future applications;
--X-band, synthetic aperture radar for the SIR-D mission;
--Programs for utilization of the SAR-X and ERS-1;
--Solid-fuel propulsion systems based on IRIS technology.

The third section refers to programs that have already been defined and that are of great strategic importance. Within the next few years, thorough feasibility studies will have to be conducted for these projects and the design phases will have to be initiated so that these programs will be ready to enter the construction phase when the main programs now in progress reach completion.

The proposed areas are the following:

--Italsat program (2nd flight unit);
--Development of new TLC [telecommunications] systems (new TLC pay laods);
--System of new subsystems for satellites;
--Work relating to the development of space stations, with particular emphasis on the logistics system for the American space station and on synthetic aperture radar for polar platforms;
--Programs for utilization of the Columbus;
--In-orbit refueling of liquid fuel and in-orbit maintenance operations.

The overall financial situation with the details for each area of activity is described on the pages following the tables, and is illustrated in greater detail in tables 1 and 2. The figures given are in billions of lire. The estimates for future years are given in billions of lire calculated at end-1985 prices.

(1) PROGR.	(2) FASI	TOT.PROG	<1987	1987	1988	1989	1990	1991	TOT.87/91
	(3) TOTALE IN CORSO	1912.32	747.66	358.81	319.45	194.30	172.10	120.00	1164.66
	(4) TOTALE CONTINUAZ.	172.50	0.00	4.00	19.50	42.00	62.00	45.00	172.50
	(5) TOTALE NUOVI PROG.	259.50	0.00	9.00	45.00	70.50	65.00	70.00	259.50
	(6) TOTALE TUTTO	2344.33	747.66	371.81	383.95	306.80	299.10	235.00	1596.66
ITALSAT	(7) SEGMENTO SPAZIALE	410.83	235.16	120.08	50.59	0.00	5.00	0.00	175.67
	(8) SEGMENTO DI TERRA	57.00	10.00	21.00	16.00	10.00			47.00
	(9) LANCIATORE LANCIO	116.89	19.37	33.50	56.52	7.50	0.00	0.00	97.52
(10) ITALSAT II	ANTICIPO PARTI	30.00	0.00	6.00	24.00				30.00
(11) OLYMPUS/ITAL.	ESPERIMENTAZIONE	18.46	0.00	5.70	2.76	2.00	4.00	4.00	18.46
(12) TETHERED	SEGMENTO SPAZIALE	124.83	68.83	24.00	24.00	8.00	0.00	0.00	56.00
	CORE EQUIPMENT	25.40	11.70	13.70	0.00	0.00	0.00	0.00	13.70
(13) IRIS	SEGMENTO SPAZIALE	166.77	131.16	28.63	6.98	0.00	0.00	0.00	35.61
(14) LAGEOS	SEGMENTO SPAZIALE	25.50	25.50						0.00
(15) IRIS/LAGEOS	OPERAZ.LANCIO	10.00	2.00	2,00	4.00	2.00			8.00
(16) SAX	SEGMENTO SPAZIALE	178.43	12.63	16.00	44.80	59.00	46.00	0.00	165.80
(17)	SEGMENTO DI TERRA	19.53	2.23	3.00	3.00	7.00	4.30	0.00	17.30
(18)	LANCIATORE LANCIO	45.00	0.00	3.50	2.50	7.00	13.00	19.00	45.00
(19) PROPULSIONE	ENDOR.+CRIOG.	49.42	2.42	8.00	10.00	16.00	9.00	4.00	47.00
(20) OSSERV.TERRA	TELERILEVAMENTO	98.45	28.85	17.30	15.30	7.00	13.00	17.00	69.60
(21)	GEODESIA SPAZIALE	36.25	13.75	7.00	4.00	3.50	4.00	4.00	22.50
(22) RICERCA BASE		149.98	49.98	10.90	15.50	19.80	27.80	26.00	100.00
(23) RIC.TECNOLOG.		74.40	26.40	6.00	6.00	12.00	12.00	12.00	48.00
(24) STUDI E SVIL.PER ATTIV.FUTURE		73.41	13.41	12.00	12.00	12.00	12.00	12.00	60.00
(25) OPERAZIONI		76.05	22.55	10.50	10.50	10.50	11.00	11.00	53.50
(26) FORMAZIONE	SPECIALISTI	9.00	0.00	1.00	2.00	2.00	2.00	2.00	9.00
(27) SIRIO		5.64	5.64						0.00
(28) CRA	S.MARCO D/L	20.00	20.00						0.00
(29) GESTIONE	STRUTTURA PSN/CNR	36.93	11.93	5.00	5.00	5.00	5.00	5.00	25.00
(30) SUPPORTO	ASSISTENZA TECNICA	29.40	9.40	4.00	4.00	4.00	4.00	4.00	20.00
(31) ANTICIPAZIONI		24.75	24.75						0.00
(32) CONTINUAZ.	TETHER CONT.+DEMO	88.00		2.00	6.00	20.00	30.00	30.00	88.00
(33)	SIR-D	45.00			5.00	10.00	20.00	10.00	45.00
(34)	UTILIZ.SAR-X+ERS-1	10.00		2.00	2.00	2.00	2.00	2.00	10.00
(35)	IRIS II+MOTORE	29.50			6.50	10.00	10.00	3.00	29.50
ITALSAT II	(36) SEC.UNITA' DI VOLO	45.00		2.00	13.00	20.00	10.00		45.00
	(37) LANCIO	0.00							0.00
	(38) NUOVI PAYLOAD TLC	35.00		1.00	4.00	10.00	10.00	10.00	35.00
(39) SVILUPPO	NUOVI SOTTOS. S/C	35.00		1.00	4.00	10.00	10.00	10.00	35.00
SPACE STATION		0.00							0.00
	LOGISTIC SYSTEM	60.00		2.00	10.00	13.00	15.00	20.00	60.00
	POLAR PLATF.SAR-X	42.00			2.00	10.00	10.00	20.00	42.00
	(40) UTILIZZ.COLUMBUS	28.00		1.00	2.00	5.00	10.00	10.00	28.00
	PREP.REFUEL+AMMU	14.50		2.00	10.00	2.50			14.50

Summary of Allocations Made and Projections

Key:

1.	Programs			21.	Space geodesy	
2.	Phases			22.	Pure research	
3.	Total Program in Progress			23.	Technological Research	
4.	Total Continued Programs			24.	Studies and Development for Future Activities	
5.	Total New Programs			25.	Operations	
6.	Total All Programs			26.	Training	Specialists
7.	Italsat	Space Segment		27.	Sirio	
8.		Ground Segment		28.	CRA	S. Marco D/L
9.		Launcher/launch		29.	Management	PSN/CNR Structures
10.	Italsat II	Provision for Parts		30.	Support	Technical Assistance
11.	Olympus/Ital.	Experiment		31.	Provisions	
12.	Tethered	Space Segment		32.	Continuation	Tether Cont. + Demonstration
13.	IRIS	Space Segment		33.	SIR-D	
14.	Lageos	Space Segment		34.	Utilization SAR-X+ERS-1	
15.	IRIS/Lageos	Launch Operations		35.	IRIS II + motor	
16.	SAX	Space Segment		36.	2nd Flight Unit	
17.		Ground Segment		37.	Launch	
18.		Launcher/launch		38.	New TLC Paylaods	
19.	Propulsion	Endor. + Cryo.		39.	Development	New Subs. S/C
20.	Earth Surveillance	Remote Surveillance		40.	Utilization Columbus	

(1) PROGR.	(2) FASI	TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
ITALSAT	(3) SEGM.SPAZIALE		410.83									
	A B	28.92		28.92								
	C/1	36.46		36.46								
	C/2	70.52			70.52							
	C/3 D	246.93				92.78	110.96	43.19				
	(4) MODIFICHE PROGETTO	10.00				3.18	3.42	3.40				
	(5) INTEGRAZIONE/PROVE	8.00				1.00	4.00	3.00				
	(6) GESTIONE IN ORBITA	10.00				2.30	1.70	1.00		5.00		
	(7) LANCIO		116.89									
	SHUTTLE	58.31		.17		10.00	24.00	24.14				
	(8) ASSICUR.LANCIATORE	21.45						21.45				
	(9) OPERAZIONI LANCIO	6.50							6.50			
	(10) TRASFERIM.ORBITALE	3.00				.50	.50	1.00	1.00			
	(11) INCREM.PER ARIANE	27.63				8.70	9.00	9.93				
	(12) SEGM.TERRA TLC	57.00	57.00			10.00	21.00	16.00	10.00			
ITALSAT II	(13) ANTICIPO PARTI	30.00	30.00				6.00	24.00				
(14) SPERIMENTAZ. DOS-OLYMP./ITALSAT		18.46	18.46				5.70	2.76	2.00	4.00	4.00	
TETHERED			124.83									
	B + BRIDGING	10.05		10.05								
	C/1	54.00			54.00							
	C/2 D	46.00					22.00	24.00				
	(15) INTEGR.+OPERAZIONI	8.00							8.00			
	SOFTWARE FOCC.	3.00				1.00	2.00					
	EGSE	3.78				3.78						
	CORE EQUIPMENT		25.40									
	(16) FASE A	.70			.70							
	(17) FASE C/D	24.70				11.00	13.70					
IRIS			166.77									
	B + C1	63.83		63.83								
	ASE	59.33				37.72	21.61					
	ISS	36.81				22.81	7.02	6.98				
	EGSE	5.30		5.30								
	(18) PROVE MOTORE	1.50				1.50						
LAGEOS	A/B/C/D/E	25.50	25.50	.70	10.93	13.87						
IRIS/LAGEOS	OPERAZ.LANCIO (19)	10.00	10.00			2.00	2.00	4.00	2.00			

Detailed Schedule of Programs Ready for Launching Within This Decade

Key:

1. Programs
2. Phases
3. Space Segment
4. Design Modification
5. Integration/Tests
6. In-orbit Management
7. Launch
8. Insurance Launcher
9. Launching Operations
10. Transfer into Orbit
11. Increase for Ariane
12. TLC Ground Segment
13. Provision of Parts
14. Experimentation DDS-Olympus/Ital.
15. Integration + Operation
16. Phase A
17. Phase C/D
18. Testing Motor
19. Launching Operations

(1) PROGR.	(2) FASI	TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
SAX	(3) SEGM.SPAZIALE		178.44									
	A	.70		.70								
	B	11.94				11.94						
	C D	163.80					16.00	44.80	57.00	46.00		
	EGSE	2.00							2.00			
	GROUND SEGMENT		19.53									
	GROUND A B	2.23				2.23						
	GROUND C/D	17.30					3.00	3.00	7.00	4.30		
	(4) LANCIO		45.00									
	(5) IRIS/OPER.	15.00					3.50	2.50	4.00	4.00	1.00	
	(6) LANCIATORE	30.00							3.00	9.00	18.00.	
(7) PROPULSIONE	(8) ENDOR.+CRIOG.	49.42	49.42			2.42	8.00	10.00	16.00	9.00	4.00	
(9) TELERILEV.			98.45									
	(10) PROGETTI PILOTA	23.99		7.19	.80	3.40	3.30	3.30	2.00	2.00	2.00	
	SAR-X(HARD/SOFT)	29.18		1.40	1.88	5.90	10.00	8.00	2.00			
	(11) ARCH.AVANZATE	12.78		2.05	5.73	.50	2.50	2.00				
	MW RADIOMETER	21.50					.50	1.00	2.00	9.00	9.00	
	VISIB.INTERFEROM.	6.00								1.00	5.00	20.00
	(12) SVILUPPI	5.00					1.00	1.00	1.00	1.00	1.00	
(13) GEOD.SPAZIALE			36.25									
	VLBI	13.01		1.51		8.00	3.50					
	(14) LASER MOBILE	7.87		.17		2.70	3.00	2.00				
	GPS - DSN - ~~strum.~~	10.50				.50	.50	1.00	2.50	3.00	3.00	
	(15) CAMPAGNE DI MISURA	4.87				.87		1.00	1.00	1.00	1.00	
(16) RICERCA BASE		45.19	149.98	22.92	7.47	14.80						
	SPACE SCIENCE	48.00					4.90	6.50	8.80	12.80	15.00	
	(17) SCIENZE TERRA	8.50					.50	2.00	2.00	2.00	2.00	
	(18) SCIENZE VITA	4.50					.50	1.00	1.00	1.00	1.00	
	PAYLOAD TETHERED	10.47			1.47		1.00	2.00	2.00	2.00	2.00	
	PAYLOAD SAX	33.32				3.32	4.00	4.00	6.00	10.00	6.00	
(19) RICERCA TECN.		26.40	74.40	13.98	2.79	9.63						
	TLC	8.00					1.00	1.00	2.00	2.00	2.00	
	(20) PROPULSIONE	8.00					1.00	1.00	2.00	2.00	2.00	
	(21) ROBOTICA	8.00					1.00	1.00	2.00	2.00	2.00	
	(22) STRUTTURE/CONTROL.	8.00					1.00	1.00	2.00	2.00	2.00	
	(23) TECNOLOG.ELETTRON.	8.00					1.00	1.00	2.00	2.00	2.00	
	(24) MICROGRAVITA'	8.00					1.00	1.00	2.00	2.00	2.00	
(25) STUDI E SVIL.PER ATTIV.FUTURE		73.41	73.41	1.05	.36	12.00	12.00	12.00	12.00	12.00	12.00	

Detailed Schedule of the Programs Based on an Annual Budget or Which Will Be Completed After This Decade

Key:

1. Programs
2. Phases
3. Space Segment
4. Launch
5. IRIS/Operations
6. Launcher
7. Propulsion
8. Endor. + Cryog.
9. Remote Survey
10. Pilot Project
11. Advanced Architecture
12. Developments
13. Space Geodesy
14. Mobile Laser
15. Measure Campaign
16. Pure Research
17. Earth Science
18. Life Science
19. Technological Research
20. Propulsion
21. Robotics
22. Structures Verification
23. Technological Electronics
24. Microgravity
25. Studies + Developments for Future Activities

(1) PROGR.	(2) FASI	TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(3) OPERAZIONI			76.05									
	TRAPANI	26.83		6.81	.93	4.09	3.00	3.00	3.00	3.00	3.00	
	MATERA	24.22		4.28	4.94	1.50	2.50	2.50	2.50	3.00	3.00	
	MALINDI	25.00					5.00	5.00	5.00	5.00	5.00	
(4) FORMAZIONE	(5) specialisti	9.00	9.00				1.00	2.00	2.00	2.00	2.00	
(6) SIRIO		5.64	5.64	5.30	.34							
(7) CRA	(8) S.MARCO D/L	20.00	20.00	20.00								
(9) GESTIONE	(10) STRUTTURA PSN/CNR	36.93	36.93	4.92	2.01	5.00	5.00	5.00	5.00	5.00	5.00	5.00
(11) SUPPORTO	(12) ASSISTENZA TECNICA	29.40	29.40	4.28	2.12	3.00	4.00	4.00	4.00	4.00	4.00	4.00
(13) ANTICIPAZIONI			24.75									
	(14) PREL. CNR	19.35			10.00	9.35						
	(15) anticipo cra	5.40				5.40						

Detailed Schedule of the Allocations for Management and Operational Activity of the Plan

Key:

1. Programs
2. Phases
3. Operations
4. Training
5. Specialists
6. Sirio
7. CRA
8. S. Marco D/L
9. Management
10. Structure PSN/CNR
11. Support
12. Technical Assistance
13. Provisions
14. Prel. CNR
15. Provisions CRA

The total amount of 1596.66 billion lire for the 5-year period is broken down into the following sections:

Section I	1164.66 billion
Section II	172.50 billion
Section III	259.50 billion

From an analysis of the projected costs for the next 5-year period, described in detail in the chapters which follow, it can be seen that there is a substantial increase in the costs of the programs now in progress. The reasons for this are the following:

--Final evaluation of the production costs, based on definition of the final design following completion of the design and development phases;
--Complexities in the projects themselves, particularly in the case of bilateral collaborative programs;
--Final evaluation of the costs of launching, the launching campaign and insurance coverage or similar measures;
--Introduction of major new areas in the basic and technological research activity and in the earth surveying activity, in order to permit development of the programs at a world level, particularly ESA programs.

With regard to extensions to programs and new programs, special attention has been paid to the need to use activity at a domestic level to guarantee adequate participation in and utilization of ESA's Columbus and Ariane 5 programs for the new space infrastructures.

Total estimated expenditures for the 5-year period 1987-91 are 1576.66 billion lire, corresponding to an average annual expenditure of 320 billion lire. This figure must be compared to the average annual figure, in real terms, of 250 billion lire estimated in the previous revision of the plan.

This will make it possible to keep expenditures on ESA activity roughly in line with expenditures at a domestic level, in compliance with the intentions expressed by CIPE at an earlier date.

From the histograph in figures 4 and 5, which show expenditures for the period 1987-91, it can be seen that the financing required for new activity gradually increases with time. This is only to be expected, as in the first years the greatest financial outlay concerns programs in the construction phase.

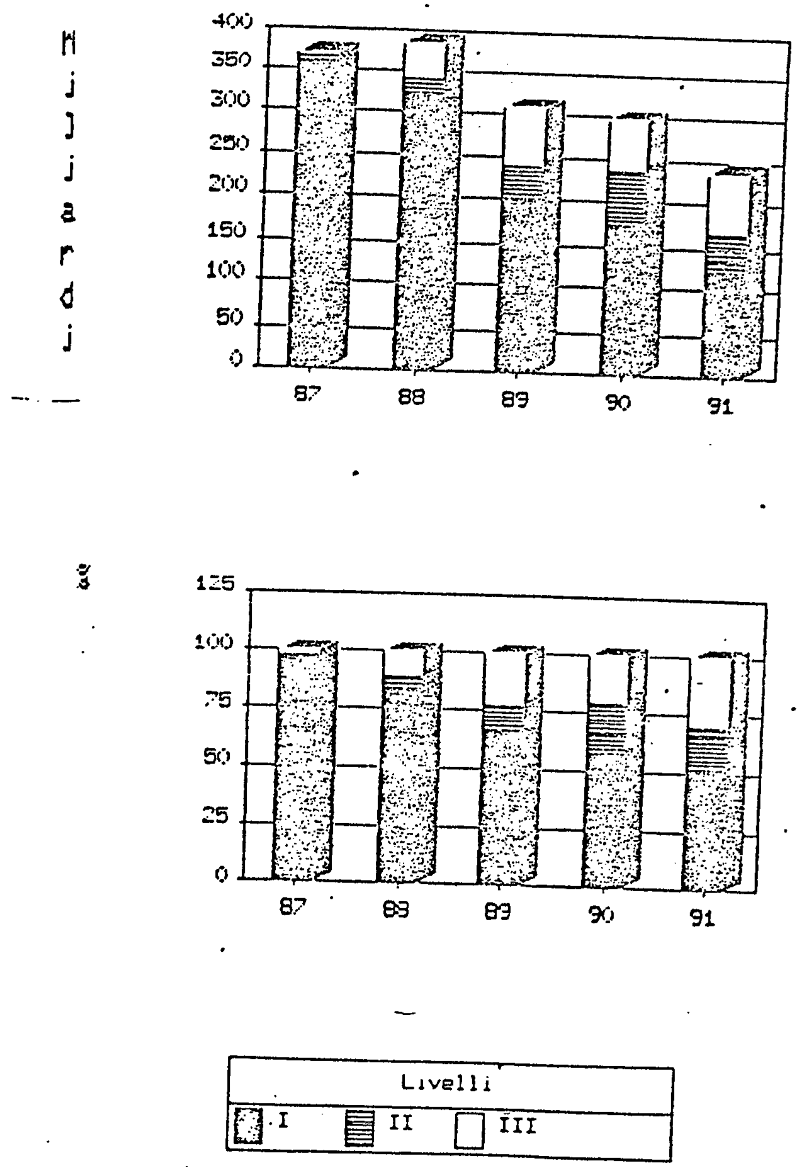
From the diagram in figure 6 it can be seen that the planning decision which had been made in the preceding years essentially remains

unchanged. This decision provided for equal funding for both mature sectors and state-of-the-art sectors. In this context, because of the major collaborative program undertaken with NASA and to which high priority is given, special attention is paid to the development of the space station, a program in which Italy, on an equal footing with other European nations, has a considerable interest.

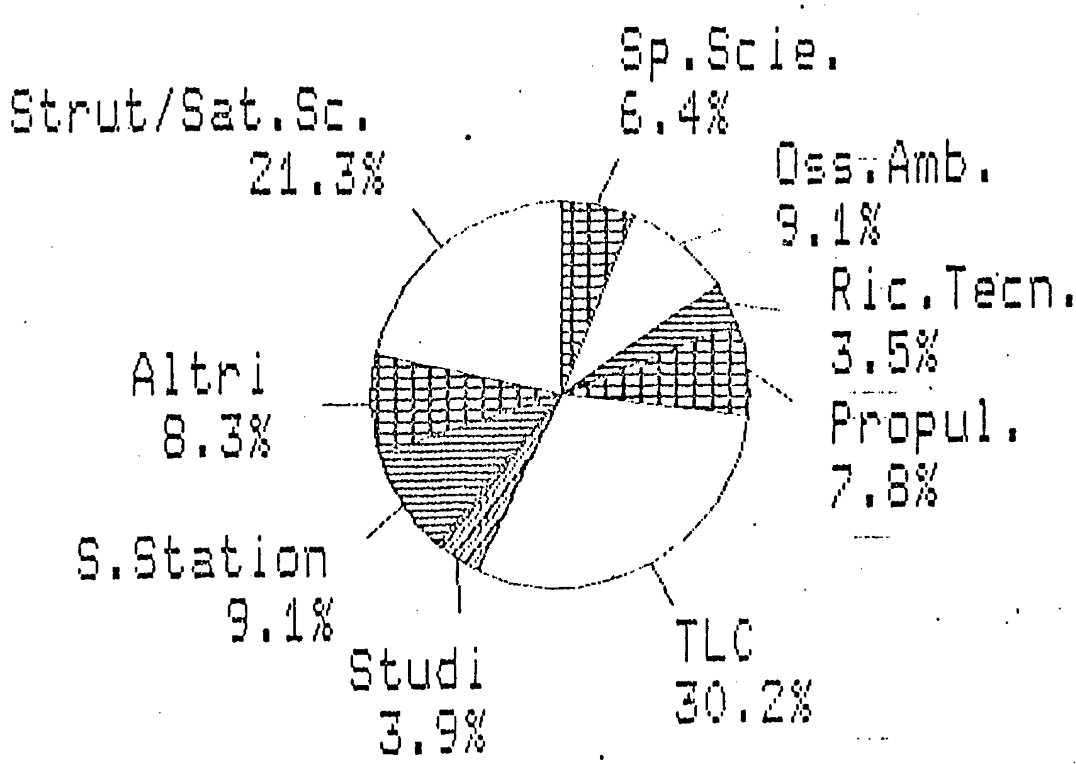
It should be emphasized at this point that, within the framework of the overall activity for which a summary of the expenditures is given in these paragraphs, the programs in sections II and III are of considerable interest because of their scientific and technical value, even though implementation of these programs according to the established schedule is something which depends on international factors.

The following pages give an in-depth technical and financial description of the work involved for these three sections.

Financing expected for level of activity
1987 - 1991



Financing expected according to sector
1987 - 1991



Programs in Progress

On the basis of the breakdown indicated in the preceding paragraph, this section deals not only with those programs that are at an advanced stage of implementation, but also with programs where the design has not yet been completed and that are scheduled to start in the next decade and, finally, with programs operated on an annual basis.

1. Programs To Be Prepared For Launching

Detailed plans are being submitted to CIPE for completion of the first and most important programs whose launch is scheduled during this decade (Italsat, Tethered, Iris/Lageos II).

It is now possible to submit accurate estimates of the sums necessary to complete these programs. These estimates take into account the effects of inflation over the last few years, variations in the exchange rate and a more accurate evaluation of the industrial activity necessary for completion, as well as the cost of launching and any insurance coverage required.

The Italsat system has been guaranteed to be compatible for launching with both the European Ariane system and the NASA shuttle system.

The interest which exists in experimenting the capabilities of the Tethered system in a variety of fields of application which are of great importance for future space activity should insure that this program is given top priotity and that the schedule established earlier will, on the whole, be respected.

Negotiations are now in progress to insure that high priotity is also given to the Iris/Lageos launch, both because of the scientific importance of the mission and because it will involve testing of the auxiliary launching system.

Space Telecommunications

1. Italsat

The developments achieved in electronic technologies and the availability of increasingly powerful launching systems have enabled telecommunications satellites to undergo a rapid evolution, making it possible to implement complete networks even in countries that have no infrastructures, as well as to develop new systems for telematic services which are characterized by high data flows and are used even by highly developed countries which have conventional telecommunications systems.

At a technological level, what we are witnessing today is a gradual progression from the initial situation, in which satellites had transparent repeaters and small, on-board antennas with corresponding large ground installations using antennas at least 30 meters in diameter, to a new phase in which satellites are capable of carrying out various types of digital data processing and switching functions, acting as genuine network nodes in space. Moreover, large on-board antennas can now be used, and this means that the power irradiated can be concentrated in highly collimated bands. This means that much smaller ground antennas can now be used and that these can be installed directly on the roofs of buildings where ground telephone traffic is concentrated.

It is expected that there will be a significant increase in telephone and telematics traffic via satellite. This will lead to overcrowding of the available frequency bands which, in its turn, will mean that increasingly high frequencies will have to be utilized and that the same frequency bands will have to be utilized several times. Moreover, there will be further crowding of the geostationary orbit in which hundreds of telecommunications satellites are stationed today.

In the future it will be possible to concentrate the transmission capacities of a number of satellites on orbiting platforms equipped with large antennas capable of producing bands which are directed to specific areas of the earth.

The Italsat program forms part of this framework. The objective of this program is the implementation of a domestic telecommunications network via satellite for experimental purposes. The design of the network is extremely advnaced, operating in the new 20/30 GHz bands with fully digital technologies and integrated services.

This network will have a capacity equal to 11,000 telephone circuits. The high degree of flexibility of the network is based on call-by-call switching functions and rapid rearrangement, and this could be of great value for the dynamic management of the entire public network at a national level. The program has been defined and is being carried out on the basis of the proposals put forward by the Post Office department for development of the telecommunications network in Italy.

1.1 Participation by Industry

Below we give a list of the various contracts awarded, showing the prime contractor and main subcontractors for each contract.

Phase A study

Telespazio	Prime contractor
CNS	Space segment
STS	Ground segment

Systems engineering

Telespazio	Prime contractor
CSELT	Recording of rainfall
STS	Systems definition and ground segment

Phase B

CNS	Prime contractor
Aeritalia	Structure/temperature control
Snia/Bpd	Propulsion system
Fiar	Power and electronic conditioning
Laben	Data handling
Selenia Sp.	P/L

Phase C/1

Selenia Sp.	Prime contractor
Selenia Sp.	P/L system, GSE [Ground Support Equipment]
Aeritalia	Structure/temperature control
Fiar	Power and electronic conditioning
GTE	P/L component parts
Laben	Data handling
Snia/Bpd	Propulsion system
Galileo	Sensors
Matra	Attitude control

Phase C/D

Selenia Sp.	Prime contractor
Selenia Sp.	P/L system, GSE [Ground Support Equipment]
Aeritalia	Structure/temperature control
Fiar	Power and electronic conditioning
GTE	P/L component parts
Laben	Data handling
Snia/Bpd	Propulsion system
Galileo	Sensors
Matra	Attitude control

In-orbit management

Telespazio	Prime contractor.

1.2 Technical Characteristics

The main characteristics of the Italsat experimental telecommunications system are those defined by phase A. These can be summarized as follows: use of the 20/30 GHz band to create flexible integration of a capacity of 11,000 digital telephone circuits in the public telecommunications network by means of the satellite and associated ground network.

The main characteristics of the system are descirbed below:

--A payload covering the national territory using multiple beams, operating at 20/30 GHz and with the following characteristics:

* Time Division Multiple Access with on-board switching using a base band matrix (SS-TDMA);
* 6 regenerative redundant repeaters with 2 multiple beam antennas, each one of which generates 3 beams;
* A transmission speed of 147 mb/second;
* Quality and availability criteria which are compatible with in this sector at an international level.

--A transparent payload covering the whole of Italy, operating at 20/30 GHz and with the following characteristics:

* TDMA (Time Division Mutiple Access);
* 3 transparent repeaters;
* A transmission speed of 25 mb/second;
* Quality and availability criteria which are compatible with activity in this sector at an international level.

--A payload for propagation tests at 20/40/50 GHz.

--Base satellite stabilized on 3 axes with unified propulsion.

--Ground segment with several stations in each band, antennas with a diameter of 3-5 meters and powers at radio frequencies of 50-100W.

a.1.3. Description of Activity

Phase A

The study for phase A of the Italsat system was conducted between 1981 and 1982 by the company Telespazio, acting as prime contractor, and by the companies CNS and STS who were responsible for the space segment (CNS) and the ground segment (STS). This study defined the configuration of the domestic telecommunications system, which will

become operational in the 1990s, analyzing the various configurations submitted and demonstrating the feasibility of the configuration selected. Therefore, this study established the characteristics of the experimental system to be implemented as part of the present space plan.

The results of the study of phase A of the Italsat system were submitted to the Technical Committee of the Post Office department for approval. The committee gave its approval and recommended that studies be conducted for definition of the telecommunications system.

The study for phase B of the telecommunications system was conducted on the basis of these recommendations.

1.4 Study of the Telecommunications System

The contract stipulated between the CNR and Telespazio for the engineering study of the telecommunications system became effective in July 1982, terminating in 1985. The main objective of the study was to define a detailed configuration of the Italsat telecommunications system, in accordance with the guidelines adopted as a result of the basic choices made at the end of phase A. The resulting design of the telecommunications system divides the functions of rapid rearrangement and switching between the satellite and the ground segment, producing a system with a high degree of integration in its space components and ground components. The satellite performs the functions of programmed rearrangement and switching on a request basis by means of ground processing in the network control center, upon request from the traffic systems.

To achieve this integration, both the payload on-board the satellite and the ground segment (traffic station and network control center) have to be developed in a well organized manner. System integration, a feature which is not required in conventional telecommunications systems via satellite, also has to be performed.

The study was completed with a definition of the specifications for the ground and on-board integrated components of the telecommunications system.

1.5 Space Segment

Phase B

The study and preliminary design activity (phase B), conducted on the basis of a contract stipulated between the CNR and CNS, was initiated in 1983 and completed in February 1984. This produced the final

configuration of the Italsat satellite, whose main characteristics can be summarized as follows:

--Compatibility with the Ariane 4 double-launch vehicle and the STS [Space Transportation System] with PAM D II;
--Launch weight 1650 kg;
--Maximum flexibility in the capabilities, achieved through the use of a unified, twin-propellant propulsion system;
--3-axis stabilization, both during the transfer stage and when in geostationary orbit;
--Capacity of 220 kg for the payload;
--Total weight without propellant 750 kg;
--Electrical power of 1450 W at end of life (5 years).

Phase C1

Upon completion of phase B, the C/D construction phase was started, with a contract for phase C1 being stipulated between the CNR and Selenia Spazio. This contract took effect in March 1984 and terminated in June 1985.

This phase was concerned with the detailed design of the most critical components for the platform and the payload. The proposal concerning all the work needed for completion of the design and production of the satellite up to delivery for the start of the launching campaign was also received; negotiations were conducted and an agreement was reached.

Phase C2

In July 1985, on the basis of the contractual agreements made with Selenia Spazio, work began on the second phase of construction of the satellite. This work was completed in February 1986.

Phase C3/D

In May 1986 a contract was stipulated for the completion of the space segment of the Italsat satellite.

The contract for production of the satellite covered the following equipment:

--2 models of the satellite (STM, EM) [Structure/Temperature Model, Electrical Model]
--1 flight unit (PFM) [Protoflight Model]
--Spare parts
--Ground support equipment.

Additional work will be needed for completion of the space segment. This work is to be developed during phase C3/D, in addition to the work now in progress and described in the preceding paragraphs. The main areas to be covered are described below.

System Integration and Testing

Integration of the payload and the communicating ground station is important for verifying that the two sections of the telecommunications system (for example, the space segment and the ground segment) are functioning properly. The integration process is also absolutely essential for verifying the command programs for the switching matrix and the communication protocol.

Testing of the systems for the structure/temperature model (STM) and the protoflight model (PFM) will be conducted at ESTEC [European Space Technology Center] or on the premises of another European body coordinated by ESA. These tests, which will make satellite testing and acceptance possible, will be carried out in the ambit of ESA in order to take advantage of the special rates granted to member nations.

Design Modifications

Because of the need to achieve outstanding capabilities, particularly with regard to the payload, certain modifications will have to be made. These modifications do not form part of the present baseline because, when the terms of the contract for the C/D phase were being negotiated, the requisite technical certainties were not yet available.

As things stand today, it is felt that these modifications can now be implemented satisfactorily. Other, more limited modifications, the need for which only became evident after the contractual negotiations had been completed, are also required as part of the work necessary to complete the design.

1.6 In-orbit Management

The services relating to the in-orbit management will be the responsibility of the Telespazio company.

The system for the in-orbit management of the satellite consists of a telemetering and remote control station (TT&C) in band S and an in-orbit control center (IOCC). Upon completion of the study for phase B, dealing with definition of this system, the technical specifications for the system and the associated subsystems were issued. The functional specifications for the computer programs necessary for self-testing and control of the satellite were also defined, as well as the

specifications required for control of the attitude and the flight dynamics of the satellite.

In order to optimize the resources needed for management of the Italsat satellite, one of the basic premises of the study is that, wherever possible, both the human resources and the equipment are shared with the in-orbit management system of the ESA Olympus satellite, which is already in progress at the Fucino Center.

The study has demonstrated that sharing of the fully steerable antenna needed for the measurement of angles will create considerable savings in the cost of equipment. As in earlier revisions of the NSP, the financial estimates calculate management of the satellite on the basis of a 2-year period in orbit. The reason for this is that it is felt that, at the end of this 2-year period, management of the satellite can be carried out and financed directly by the communications organizations involved in the experimental operation of Italsat.

1.7 Launcher and Launch

Dual compatibility is of fundamental importance for a satellite designed for experimental use and which is then to become fully operational and which may also be used for other geostationary missions beside the Italsat mission (for example, direct broadcasting, emergency communications, technological telecommunication loads, and so on).

Dual compatibility means that there is a certain flexibility in the choice of launcher in relation to parameters of cost, timing, and reliability. These parameters can alter significantly with time, and this means that if a satellite is designed for operational applications, the possibility of using only one launching system is excessively limiting.

From the beginning of phase A, the Italsat has been designed, developed and subsequently produced to have this characteristic of dual compatibility.

At a technical level, dual compatibility is maintained throughout the development phase up to testing of the satellite. In this way, the flight unit can be adopted for both the STS and the Ariane IV, since the design is suitable for both these systems.

--Choice of launcher

As we have seen in the preceding point, while the choice of the launcher is not of fundamental importance for development of the design, it is when it comes to the definition of the launching scenario and related activity and for placing the satellite in orbit.

This activity normally starts between 30 and 36 months prior to the beginning of the launching period.

The details of the choice of the launcher are not examined here but, given what we have just said, this choice will have to be made by May 1986.

--Launching campaign

The hourly cost of the personnel required for the launching campaign is identical for both launchers. There will be a difference in the overall cost of the two campaigns only because of the fact that one is longer than the other and because the personnel involved will have different responsibilities.

The cost of transportation of the satellite and the necessary insurance coverage is considered to be the same in both cases. The traveling expenses of the personnel to and from the launching base are also the same.

--Insurance

For satellites that are to be used for operational applications, it is normal procedure to insure both the satellite and the launch (both of which would have to be repeated if the mission were unsuccessful). This coverage applies to the period of time which elapses between the moment when the launching vehicle leaves the ground and the moment when the satellite is accepted in orbit (within 180 days following launching). Insurance coverage must also be taken out against risks during the launching campaign and the in-orbit life of the satellite. The cost of this insurance is almost identical for the Ariane launch and the STS [Space Transportation System] launch.

The estimated cost of a second Italsat module is 82.7 billion lire. If we subtract from this figure the 30 billion lire which have already been provided for spare parts for the second flight unit, the cost to be insured is 52.7 billion lire.

For the launch itself, the values to be insured are 58.15 billion lire (Ariane) and 40.76 billion lire (STS) if the option of relaunching at a reduced cost, offered by NASA, is selected. The insurance rates available on the international markets prior to the incident which occurred in the second half of 1985 were 25 percent for the Ariane launch and 22.5 percent for the STS launch.

The difference between the two rates is directly related to the respective levels of reliability of the two launching vehicles used.

--Transfer into orbit

The transfer orbit, which begins at the moment when the satellite leaves the launcher and ends when the orbital position is reached, will be followed by the ESA tracking network and controlled by either the ESOC (European Space Operations Center) Control Center or by an Italian control center.

The fact that the satellite operates in band S (for telemetering and remote control) could make it necessary to select the ESA network. Moreover, the ESOC control center may represent the correct choice for the phase during which the satellite is placed in orbit, as this is a delicate phase during which the necessary operations must be performed in real time and, therefore, requires personnel with extensive experience.

When the above factors are considered as a whole, there is a substantial difference in the estimated costs of the two launching vehicles and other related items. The financial tables therefore specify the estimated costs in both cases.

1.8 Ground Segment for TLC [telecommunications] and Propagation

The study conducted on the telecommunications system for phase B defined the communications and propagation systems for the ground segment. Upon completion of this study, the relevant specifications were issued, including the specifications for a network control center.

The specifications for the telecommunications ground segment are now being revised by experts appointed by ISPT, SIP, and Telespazio. Negotiations are also in progress with Selenia Spazio concerning the contract for the development and production of the prototype of the traffic station and the network control center.

After the prototype phase, the traffic stations and the network control center will be acquired directly by the telecommunications organizations involved (ISPT, SIP, Telespazio). On the basis of the provisions of the investment programs of these organizations, it is estimated that a minimum of nine stations will be installed.

Management of the network control center and the traffic stations will be the financial responsibility of the telecommunications organizations from the time the satellite is accepted in orbit.

Work is now in progress with the experimental personnel for the final definition of the specifications for the complete 20/40/50 GHz propagation station (large station). Development and construction of the station will begin during 1986 and will focus mainly on the 20, 40 and 50 GHz receiver equipment. In addition to the CNR/CSTS propagation station, other 20/40/50 GHz propagation stations (large stations) will be acquired by ISPT/FUB and CSELT.

Small stations operating at a frequency of 20 GHz and which can be used to receive either Olympus or Italsat will also be constructed. These small stations will be bought using ISPT/FUB funds and will be operated by these organizations.

1.9 Status of the Program and Planning

Status of the program

--Work completed

The work established under the following contracts for the implementation of the Italsat program has been completed:

1. Feasibility study of the entire system (phase A);
2. Study for the telecommunications system;
3. Definition of the space segment (phase B);
4. Construction of the space segment (phase C/1);
5. Study for the in-oribt management (phase B).

--Work in progress

The work established under the following contracts is now in progress:

6. Construction of the space segment (phase C/D).

--Work to be implemented in the near future:

The contracts are now being prepared for the following work:

7. Design and construction of the prototype of the ground stations for telecommunications and propagation (phase B2/C);
8. Execution of the orbital transfer;
9. Purchase of the launcher;
10. Implementation of in-orbit management;
11. Launching operation.

Development Times

The development times, particularly for the space segment and ground segment, are typical of a situation in which there are no contractual difficulties and/or funding problems; nor are there any unforeseen technological problems.

The most important stages in the development of the space segment are the following:

--Start of phase C/D	July 1985
--Total length of phase C/D	39 months
--Structure/temperature model	December 1986
--Electrical model	May 1987
--Protoflight model (PFM)	February 1988
--Completion of testing of the PFM	October 1988
--PFM available	December 1988
--Launching period agreed upon	12 months
--Length of the launching campaign	2-4 months.

1.10 Contracts Awarded

The contracts awarded for the Italsat program are listed below (the costs are shown in billions of lire):

Phase	Description	Contractor	Cost
A	Configuration	Telespazio	2.85
A	In-orbit management	"	1.09
B	System	"	6.40
B	Design	CNS	18.33
B	Consultancy	Telespazio	0.11
B	Review document	CNS	0.14
Launching	Booking	NASA	0.17
C1	Development	Selenia	36.46
C1	Review document	"	0.42
C2	Construction	"	70.10
C3/D	Construction	"	246.93

Provision of Parts for Italsat II

In order to be able, in the event of a fault, to relaunch the satellite within a maximum period of 2 years, a number of spare parts must be made available in addition to those provided in the present program for the first flight unit.

Moreover, these additional spare parts can be used in conjunction with the minimum number of spare parts already provided to reduce the risks involved in the final phase of testing of the satellite and the subsequent launching campaign.

Finally, these parts can be used in the construction of the second flight unit, thereby reducing the total cost.

2. Olympus / DBS [Direct broadcasting by satellite]

The work of the Italsat program has been coordinated with ESA activity for the Olympus satellite, a program to which Italy is making a major contribution.

So that it would be possible to utilize the Olympus payload (20/30 GHz communication payload, propagation payload and 12/18 GHz DBS payload), the work has been carried out within the framework of the work for implementation of the Italsat ground segment for communication and propagation. It is, in fact, expected that the RF (radio frequencies) section of a 20/30 GHz communication station will be made available for Olympus. This is the result of development of the RF section of the Italsat traffic station.

The 12/20/30 GHz propagation station (large station) will be implemented by developing both the RF section and the baseband measurement and processing section. The latter part will also have to be used for the Italsat propagation station.

For direct broadcasting by satellite, an engineering prototype receiver will be employed that will incorporate all the applicable technological developments based on the MONOMIC program which was completed in 1984. The DBS program will therefore represent the logical conclusion of this earlier program.

3. Financial Schedule

The financial schedule for development of the global telecommunications program, including the Italsat and Olympus/DBS program, is given below:

Table 2

(1) PROGR.	(2) FASI	(3) TOTALI	(4) TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
ITALSAT	(5) SEGM.SPAZIALE		410.83									
	A B	28.92		28.92								
	C/1	36.46		36.46								
	C/2	70.52		.	70.52							
	C/3 D	246.93				92.78	110.96	43.19				
	(6) MODIFICHE PROGETTO	10.00				3.18	3.42	3.40				
	(7) INTEGRAZIONE/PROVE	8.00				1.00	4.00	3.00				
	(8) GESTIONE IN ORBITA	10.00				2.30	1.70	1.00		5.00		
	(9) LANCIO		116.89									
	SHUTTLE	58.31		.17		10.00	24.00	24.14				
	ASSICUR.LANCIATORE (10)	21.45						21.45				
	OPERAZIONI LANCIO (11)	6.50							6.50			
	TRASFERIM.ORBITALE (12)	3.00				.50	.50	1.00	1.00			
	INCREM.PER ARIANE (13)	27.63				8.70	9.00	9.93	—	—	—	
	SEGM.TERRA TLC (14)	57.00	57.00			10.00	21.00	16.00	10.00			
ITALSAT II	ANTICIPO PARTI (15)	30.00	30.00				6.00	24.00				
SPERIMENTAZ.	DBS-OLYMP./ITALSAT (16)	18.46	18.46				5.70	2.76	2.00	4.00	4.00	

Key:

1. Program
2. Phases
3. Totals
4. Total program
5. Space segment
6. Design modification
7. Integration/Tests
8. In-orbit management
9. Launch
10. Insurance
11. Launch operation
12. Transfer orbit
13. Increase for Ariane
14. TLC ground segment
15. Provision for parts
16. Experimentation DBS/Olympus/ Italsat

The cost of launching the Italsat satellite has been calculated showing the cost both if the shuttle were to be used and if the Ariane were to be used.

4. Economic and Financial Analysis

Table 2 above gives the breakdown of the costs for the telecommunications program presented for the latest revision.

From a comparison between the completion costs shown in table 2 and the estimated costs given in the 1983 plan, using 1983 prices for the purposes of comparison, it can be seen that the costs have increased by about 97 billion lire in real terms since the 1983 estimates.

Space segment

The total increase in this entry is 56 billion lire. From this total we must subtract the sum of 9 billion lire which was allocated but has not yet been spent and is therefore still available.

This leaves us with an increase of 47 billion lire, the result of a more accurate evaluation of the following items:

--Integration of system/eng. TLC/use of ESTEC facilities;
--Ground support equipment;
--Spare parts/modifications.

Launcher/launch

This area of activity refers to the launch using the STS. The total increase compared with the earlier estimate is 28 billion lire. The main reasons for this increase are to be attributed to variations in the dollar exchange rate, the quotation for the PAM D II (not available in 1983), a large variation in insurance rates over recent years and, finally, the cost of transfer into orbit.

The increase can therefore be broken down as follows:

-- STS + PAM D II

Insurance

--Transfer into orbit and associated support

An analysis of the cost of using the Ariane launcher was conducted at the express request of the minister for research. This analysis showed, compared with the estimated cost of the shuttle, that the increase would be 27.63 billion lire.

Ground segment

The total increase of 22 billion lire is to be attributed to the estimated cost of developing the baseband section of the traffic station and the cost of developing the software for the network control center. Certain factors necessary for definition of the system available to us today were not available in 1983 and, in fact, the estimate given in the plan approved in 1981 was not updated in the 1983 revision.

Tethered Satellite System (TSS) / Core Equipment

1. Introduction

The principle of using a "tether" connected to the space shuttle to release a platform which could be used to conduct multidisciplinary research at various altitudes in the ionosphere was first formulated in 1974 by Professor Colombo. The idea was then developed, with support from a number of scientific sectors in the United States.

This proposal was believed to be so interesting that NASA and NSP/CNR [National Space Plan/National Research Council] selected a number of potential scientific and technical applications with the aim of starting an organized contribution by Italy to NASA's Space Transportation System. For this purpose, a delegation from MRST [expansion unknown] and NSP started negotiations with NASA in 1980 for the definition of a collaborative program which was given the name of TSS (Tethered Satellite System). The objective of this program was to install a system known as a deployer on the shuttle. This system would release a satellite weighing 500 kg to a distance of 100 km upward or downward, and would then recover the satellite.

Use of a tethered satellite system of this kind means that the space shuttle can be utilized as an operational base for releasing and recovering platforms which are to be used for scientific experiments and the testing of applications in orbital dynamics, plasma dynamics, microgravity, the generation of power in space, the propagation of low frequency electromagnetic waves, magnetodynamics, the physics of the atmsophere, earth surveying, and so on.

The use of tethered platforms will give space stations an extremely high degree of operational flexibility. As the construction of space stations is scheduled to take place in the early 1990s, the first flight of the TSS can also be regarded as early testing of the system for use in future programs. It is evident that the possibility of utilizing the TSS in space stations will place our country at an advantage, both technologically and in operational terms. It is also

clear that implementation of this program will not be seen as an end in itself but, on the contrary, will be used to provide the basis for a number of subsequent applications.

The substantial degree of interest in this program shared by both NASA and NSP/CNR led to the decision, in the spring of 1981, to sign a Memorandum of Understanding to start the initial phase of the program. This initial phase was concerned with the definition and preliminary design of the system, definition of the interfaces and the development of certain areas of critical importance both from an engineering standpoint and, more importantly, in terms of dynamics. The specific areas of responsibility of NSP/CNR concern the definition, design and construction of the TSS, as well as the technical work necessary for integration of the scientific experiments on-board the satellite.

The real significance of the signing of the Memorandum of Understanding (March 1984) between NASA and CNR, and of the signing of the covering letter by the Italian and American governments was to initiate a long-term collaborative program in which the scientific and engineering objectives of the first mission represent only a small part, albeit an extremely important part. Because of this, it is absolutely essential that the timeframe established for the various stages of the first mission be respected, since this mission is regarded as a preparation, in terms of activity, for subsequent missions.

1.1 Participation by Industry

The prime contractor for the TSS program is Aeritalia, which will be responsible for the development, production, integration, and testing of the satellite.

The companies listed below will act as subcontractors for Aeritalia in this program. The responsibilities and areas of activity of these companies are shown below

Fiar:	Development, construction and testing of the electricity supply and distribution system;
Snia/Bpd:	Development, construction and testing of the propulsion subsystem;
Laben:	Development, construction and testing of the data handling subsystem, associated software and EGSE [Electronic Ground Support Equipment] software;
Selenia:	Development, construction and testing of the telemetering and remote control subsystem;
Galileo:	Supply of the sensor units for the observation of the earth and the sun and the related electronics.

1.2 Contractual Position

The contracts that have been awarded so far for the TSS program are shown below (the figures are in billions of lire, calculated at end-1985 prices)":

Phase	Description	Contractor	Cost
B	Design	AIT	4.12
B	Core equipment	"	0.70
B/C	Bridging phase	"	5.93
C1	Construction	"	54.00

1.3 Technical Characteristics

For the first time ever, a satellite will be constructed which can be released and then recovered at the end of the mission by means of a tether. The new and unique nature of this program has induced industry in Italy to apply design criteria based on innovation and advanced technologies.

The technical aspects of the construction of the attitude control system, the on-board data handling subsystem and the propulsion module of the satellite are particularly significant.

The satellite is also designed to be compatible with the mission, in-orbit, and interface requirements of the shuttle/deployer.

Once the satellite has been placed in a circular orbit, satellite operation is governed and controlled by the shuttle/orbiter. To be more precise, the satellite is released from the orbiter either toward the center of the earth or in the opposite direction. It is maintained in a stationary position at a certain distance and is then recovered by the orbiter.

Depending on the type of mission to be performed, the satellite can be connected to the orbiter using either a non-metallic wire or an electrically insulated conducting wire.

First mission

The first mission will act as a demonstration, in engineering terms, of the operational feasibility of the principle of the TSS, and of the performance of electrodynamic experiments at a distance of up to 20 km from the orbiter in the direction of the center of the earth.

Operational life

The satellite is designed to have an operational life of 6 years, performing at least 2 missions in addition to the first mission once the necessary modifications and maintenance work have been completed.

The second mission will be an atmospheric mission. In this case, the satellite will be required to remain at altitudes of about 130 km for approximately 20 hours, during which time scientific data will be collected.

The third mission, like the first one, will be an electrodynamic mission. The objective in this case will be to conduct new experiments and to implement and verify the results of certain experiments performed during the first mission.

The scientific experiments must be compatible with the design of the satellite, the expected operating conditions for each mission and the resources provided by the satellite.

Special Technical Characteristics of the Satellite

The technical characteristics of the satellite have been defined by the study for phase B and the bridging phase. These characteristics are necessary to satisfy the following conditions:

--To give the satellite a high degree of operational flexibility;
--To satisfy the interface requirements with the satellite's release and recovery system (deployer), which is now being constructed by Martin Marietta Aerospace (;
--To satisfy the interface requirements with the space shuttle;
--To provide a space platform with capabilities that will offer scientists a wide range of possibilities for experiments over a broad spectrum.

The following paragraphs give a description of the most important units in the system. The satellite is spherical in shape and has a diameter of 1.6 meters. It consists of 3 modules which have basically diversified functions and which can be integrated separately.

a) Service module.

This has the following capabilities:

--To supply the electrical power necessary to perform the mission;
--To check the temperature of the various on-board subsystems, sending the telemetering data to the space shuttle and the POCC (Payload

Operation Control Center);
--To receive telecommands from the space shuttle/POCC;
--To handle the on-board operational and scientific data;
--To calculate and control the satellite attitude during the various stages of the mission.

b) Propulsion module.

The functions of this module are the following:

--To control the attitude of the satellite;
--To effect satellite rotation, controlling such rotation;
--To create the necessary tension in the tether so that the dynamic operations for release and recovery of the satellite by the shuttle can be performed. At an overall system level, these functions are of vital importance.

c) Module for scientific load.

The functions of this module are the following:

--To house the instrumentation necessary for the scientific experiments which are to be conducted;
--To supply power to the various scientific loads and acquire data from them.

The main subsystems of which the satellite is composed (structure, power supply, data handling, telemetering and remote control, attitude control, propulsion) have been designed to provide the requisite system capabilities. These are the following:

--Total weight: 500 kg;
--Electrical power: Ag-Zn batteries with a minimum rated power of 7600 Whr during the entire operational phase of the mission;
--Data handling/telemetering/remote control: 32 Kbytes - 16 Kbits - 2 Kbits;
--Attitude: attitude control capability of 3 degrees, measurement accuracy of 1 degree (in real time) and 0.3 degrees (following ground-based processing);
--Propulsion system: total thrust of 32,000 N.s.;
--Allocation for scientific load: 66 kg.

1.4 Description of Activity

The TSS program is divided into the following phases:

--Phase B and bridging phase

The studies for phase B and the bridging phase were conducted in 1983-84 by Aeritalia, which acted as prime contractor. At the end of these two phases, the following objectives had been achieved:

--Definition of the satellite configuration;
--Freezing of the system, subsystem and ground testing equipment specifications;
--Completion of the dynamic and technological support studies;
--Definition of the programs for quality control, configuration, development and testing;
--Final definition of the design.

These studies, therefore, defined the final configuration of the satellite, the technical characteristics of the satellite, and the total package of work necessary for development of the subsequent stages of the program.

The technical results obtained from the studies for phase B and the bridging phase were then submitted to the partner in the program, NASA, and to the Martin Marietta Aerospace for approval, in order to check the interfaces and joint operating capabilities of the satellite/deployer/shuttle.

Phase C/1

At the end of the bridging phase, work started on construction of the satellite and the associated ground testing equipment. This was done under a contract drawn up for phase C/1 between the CNR and Aeritalia (acting as prime contractor), effective from November 1985 and lasting for 13 months (ending in December 1986).

During this phase, detailed designs were produced for the most critical subsystems and units, a final definition was produced of the overall design of the system, the subsystems and the ground testing equipment and, finally, the construction drawings for the satellite were completed.

In addition, negotiations were conducted and agreement was reached on the proposed work for the next phase of the program,

Phase C2/D

This phase will start in January 1987, covering the work necessary to construct the satellite and prepare it for delivery (December 1987).

Two models will be developed (STM, EM) (Structure/Temperature Model, Electrical Model). Two satellite deployer interface simulators, one

flight unit, and the related ground testing equipment will also be developed.

Subsequent phases

In order to finalize and complete the program, including the launching phase, certain work will have to be done after the satellite has been constructed, accepted and delivered to the CNR. The work needed, which will mainly involve the technical support for the integration and checking operations in the United States, will be defined during phases C1 and C2/D.

1.5 Status of the Program and Planning

The Tethered program is now in the phase of construction of the satellite for the first mission. The contract for phase C1 has been drawn up with Aeritalia as prime contractor. Under the terms of the contract, Aeritalia undertakes to construct and deliver the satellite, whereas funding is limited to the levels of financing presently available.

--Work completed

- --Study and preliminary design (phase B);
- --Definition and design (bridging phase);
- --Detailed design of the system, subsystems and related ground testing equipment;
- --Analysis of the system and subsystems;
- --Project Requirement Review and Preliminary Design Review of the satellite and satellite subsystems;
- --Project Requirement Review and Preliminary Design Review of the integrated TSS system (deployer and satellite);
- --Safety Reviews for phase "0" and "1" with NASA;
- --Preliminary definition of operational activity before, during and after the mission.

--Work in progress

- --Issuing of the construction drawings and assembly procedures for he satellite models;
- --Purchase of materials, parts and components;
- --Construction of the satellite subsystems;
- --Design of the mechanical and electrical simulators for verifying the interface with the deployer;
- --Definition and planning of test activity.

Work to be done

Phase C1

--Critical Design Review of the satellite;
--Critical Design Review of the TSS (deployer and satellite);
--Construction of the mechanical and electrical simulators;
--Delivery of experiments for integration on the satellite;
--Preparation of the engineering model.

Phase C2/D

--Construction of the ground equipment and related software for satellite control during the mission;
--Construction and testing of the structural model;
--Integration of the experiments on the flight unit;
--Construction and testing of the flight unit.

Work to be done in subsequent phases

--Operations

This involves the technical support for the following areas of activity:

--Delivery of the satellite, test equipment, and related software to Martin Marietta Aerospace for the integrated tests with the deployer;
--Integrated tests of the satellite/deployer/shuttle at the Kennedy Space Center;
--Preparatory operations for the launch;
--Launch;
--Analysis and evaluation of the in-flight capabilities of the satellite and the scientific results;
--Software and Payload Operation Control Center (POCC).

In parallel with phase C/D, the software requirement for ground control of the satellite and core equipment has to be defined, incorporated, and checked. Technical specifications for the software also have to be developed and applied, so that the values of specific data on satellite behavior can be determined extremely accurately.

--Planning

The planning shown below covers the present contractual commitments. It makes no allowance for the new developments which have emerged since the Challenger incident. This planning is to be revised on the basis of the new launching schedule which will be defined by NASA.

--Construction simulators (mechanical and electrical)	Nov 1986
--Completion of phase C1 (engineering model)	Dec 1986
--Delivery of experiments for integration	Jan 1988
--Phase C2/D (structural model, flight unit)	Jan 1987/Mar 1988
--Operations	Jan 1988/Dec 1988
--Software POCC	Apr 1986/Oct 1987
--Evaluation of in-flight behavior	Oct 1988/Mar 1989
--First mission	Sep 1988

As things stand today, the most probable date for the first mission is in the second half of 1989.

1.6 Financial Situation

The table below shows the cost of the activities listed above:

Table 3

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
TETHERED			124.83									
	B + BRIDGING	10.05		10.05								
	C/1	54.00			54.00							
	C/2 D	46.00					22.00	24.00				
	(4) INTEGR.+OPERAZIONI	8.00							8.00			
	SOFTWARE POCC.	3.00				1.00	2.00					
	EGSE	3.78				3.78						

Key:

1. Program
2. Phases
3. Totals
4. Integration + Operations

2. Core Equipment

Introduction

The main task of the core equipment system of the TSS is to provide a general, practical facility and one which is absolutely essential for a vast range of scientific and technological experiments. These experiments can be conducted either on the satellite or on the pallet of the TSS. The pallet is located on board the orbiter.

In particular, it will be possible, on electrodynamic missions, to control the electrical potential of the satellite and the flow of current produced by means of the tether between the satellite and the

orbiter as a result of the electromagnetic field guaranteed by the movement of the TSS through the geomagnetic field. This function is of fundamental importance for operation of the electromagnetic tether. It is also essential for almost all scientific experiments in space plasma physics and the electrodynamic phenomena utilized by the TSS.

The core equipment is a standard facility of the TSS. It has the following functions:

--To increase the operational capabilities of future missions by satisfying the requirements of specific scientific experiments (such as, for example, gravimetric studies) on the basis of the information acquired by the dynamic package;
--To provide, by means of the electrodynamic subsystem, operational support for controlling "tether current-voltage," characterized by extremely high flexibility for the integration of the individual electrodynamic experiments by the principal investigator (PI).

It is obvious that the major contribution made by Italy to the development of the core equipment represents a great opportunity in terms of:

--Participation at systems level in the TSS, specifically for electrodynamic missions;
--Acquisition by Italian industry of a specific background in one area of technology which is not very highly developed in Europe and which has great potential for future applications;
--Practical participation in the development of specific technologies for the space stations of the future; these technologies include the generation of electrical power or of corrective forces for the attitude makeup.

2.1 Participation by Industry

The following companies have been assigned responsibility for phase A (definition) of the core equipment program:

Aeritalia:	prime contractor, responsible for the system;
Fiar:	high voltage power supplier with low output current;
Laben:	operational switches and motors, electronics of the electron generator, data handling, system integration;
Valfivre:	electron generator;
CISE:	system research for the accelerometer package.

2.2 Technical Characteristics of the Core Equipment

The core equipment consists of the following two units:

1. Dynamic package (located on the satellite of the TSS);
2. Electrodynamic subsystem (located on the satellite and on the pallet).

The first unit consists of special instrumentation (3 axis gyros and 3 axis accelerometers) which are used to define the dynamic environment to which the satellite is exposed during the mission. The second unit is required for conducting the electrodynamic experiments and, in particular, the generation of electricity and of forces for the control of orbit. The basic instrumentation of the second unit is an electron generator with state of the art technical and technological characteristics.

2.3 Description of Activity

The principle objective of phase A, which was completed in May 1985, was to analyze the system configuration and requirements. The definition study also identified the critical areas, which essentially involve the technical characteristics of the electron generator.

Because of the critical nature of the planning schedule of the TSS program, and in order to respect the joint commitments with NASA, it was decided to include the basic work of phase B in phase C/D. As a result of this, the main objectives of phase C/D are the following:

--Systems, subsystems and GSE specifications;
--Programs for quality control, configuration, development and testing;
--Final definition of the design;
--Issuing of the construction drawings;
--Purchase of materials, parts, and components;
--Construction of the subsystems and units;
--Tests for verification, acceptance, and final testing.

It must also be emphasized that phase C/D, already critical because of factors inherent in this phase, is made even more critical because of the technical characteristics required of the electron generator, characteristics which have not yet been implemented at an international level.

Guarantees must also be given for the following work:

Operations

--System testing on the premises of Martin Marietta, Denver;
--Integration and testing of the system on board the shuttle;
--Operational phases of the mission;
--Post-operation phases, for example, up until 3 months after the mission.

2.4 Status of Program and Planning

The study for phase A was completed in May 1985. The schedule for the work necessary for completion of the core equipment program is given below. This schedule is subject to modification as a result of NASA's revised launching schedules.

--Completion of the simulator for shuttle interface	Feb 1987
--Completion of phase (B) - C/D	Dec 1987
--Operations	Jan 1988/Dec 1988
--First mission	Sep 1988

In the light of the Challenger incident, the comments made regarding the Tethered program also apply to the core equipment program.

2.5 Financial Schedule

The table below shows the costs for the work described above:

Table 4

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
	CORE EQUIPMENT		25.40									
	(4) FASE A	.70			.70							
	(5) FASE C/D	24.70				11.00	13.70					

Key:

1. Programs
2. Phases
3. Totals
4. Phase A
5. Phase C/D

3. Economic and Financial Analysis (TSS - Core equipment)

In the course of phase B and the bridging phase, NASA and the NSP identified the critical areas on the basis of a definition of the interface data between the deployer and the satellite (responsibility of NASA) which gave values that were higher than those intially estimated.

Another critical area was found to be the interface functions between the shuttle and the satellite. In addition to this, NASA and the NSP have had to cope with the emergence of operating requirements that were more restrictive than those originally estimated and, as such, meant that it was necessary to carry out design modifications both to the deployer and to specific subsystems of the satellite.

From the results of the detailed design produced by the work of phase B and the bridging phase, it was seen that it would be necessary to develop a more complex system than the one originally envisaged. The main reason for this was that it was essential to guarantee high levels of control and reliability that would eliminate any possibility of danger to either the shuttle or the astronauts during the phases of release and recovery of the tethered satellite, as these are delicate phases and ones which had never been tested before this time. For these reasons, the cost of the program reflects a number of technical and scientific requirements agreed upon by NASA and the NSP; these requirements produced a more complex and more costly satellite configuration than originally foreseen. What we must remember is that no previous experience with tethered satellites exists and that because of this, a number of completely new problems and technical complications arose which had to be dealt with and solved during the design phase. In response to this development, CIPE issued authorization on 1 August 1985 for CNR to make the necessary adjustments, effective from 1985, in the allocation of available financial resources in order to meet the new, increased requirements which had come to light for the TSS program.

These new requirements are reflected in the financial planning schedule for phases C/1 and C/2D of the TSS program which is given in table 1.2.

The entries for phases C/1 and C/2D are sums that have been agreed upon and are therefore final. The amount shown for EGSE [Electronic Ground Support Equipment] reflects the offer made by Aeritalia and is therefore to be regarded as a maximum amount that will not be exceeded. It can be seen that the costs for "Operations" refer to the technical support of industrial personnel for the TSS systems activity scheduled to take place in the United States (Martin Marietta and NASA) in 1988. This support work also includes the work required in the 3 months

following the mission (October, November, December 1988). The costs for "POCC" [Payload Operation Control Center] and "Evaluation of Behavior" mainly concern the definition, development, and testing of the software necessary for control of the satellite-core equipment during the mission and for determining specific flight engineering data with the high degree of accuracy required for the TSS mission. The entry "Tether Refurbishment" consists of the cost of the work hours associated with the 3 missions (2.0) and the value of the material (15.0) constituting a credit line which can be managed by the CNR through a controlled cost contract.

The estimated expenditure for phases (B) - C/D for the core equipment program are higher than the estimate submitted to CIPE in 1983.

The main reasons for this increase are the following:

--Following joint meetings between NASA and the NSP, it became evident that it was necessary to upgrade the technical and scientific characteristics of the electron generator in order to bring them into line with top international standards. This will create significant advantages in both scientific terms and in terms of application in very low frequency communications, as well as in relation to future developments in space stations;

--Difficulties concerning the availability of fully developed subsystems which could be applied directly, as these were less readily available than had been envisaged.

The "Operations" entry is to be regarded as accounted for in the same entry for the tethered satellite, since the technical support personnel can satisfy the requirements of both programs (since one and the same company is responsible for both the TSS and the core equipment program).

The costs specified in this proposed revision make no allowance for the possibility of major delays caused by changes in the NASA launching schedule.

Iris/EGSE [Electronic Ground Support Equipment]

1. Iris

1.1 Introduction

The Iris system forms one of the stages of orbital propulsion integrated in NASA's STS (Space Transportation System). These stages are necessary for transfer of the payloads for the initial stationary orbit and the final orbit required for the mission.

The Iris is a completely Italian design, utilizing innovation and advanced technology and exploiting the experience of some of the foremost companies in this sector in Italy, such as Aeritalia, Snia/Bpd, Laben, Fiar and Microtecnica.

The special features of the Iris can be summarized as follows:

--A program which is closely "integrated" with NASA's Space Transportation System (STS), both from a technical point of view and in operational terms. This program will enable Italian industry to acquire in-depth knowledge of aspects that are totally new in Europe;
--This is the first time that a complete orbital propulsion system using an advanced rocket motor and fitted with all the equipment necessary for the operations listed below has been produced in Italy;

--Transportation of the STS in the hold;
--Automatic control of operation of the on-board units, insuring correct functioning of these units;
--Spin stabilization;
--Protection from solar radiation;
--Release of the propulsion stage from the shuttle;
--Control of nutation;
--Start-up of the motor and release of the propulsion stage from the payload;
--Once the Iris system has been constructed and "tested" on the basis of its first flight, it will be possible to utilize and market this system for numerous missions at both a national and international level.

The Iris was designed to satisfy the requirements of the category of satellites which have a mass of between 450 and 900 kg, since the American "upper stages" (PAM D-1 and PAM D-2) are designed for use on satellites with a minimum mass of 1000 kg and are therefore unsuitable for these smaller satellites.

The Iris is composed of two modules with essentially diversified functions. These modules are the ASE (Airborne Support Equipment) module, which can be reutilized, and the ISS (Iris Spinning Stage) propulsion module.

The ASE module, which will be installed in the hold of the shuttle, guarantees all the functions needed for transportation and for preparation for the release and launching of the ISS module and its payload.

In turn, the ISS module is equipped with all the subsystems required for flight assistance and stabilization of the stage and passenger satellite up to start-up of the solid propellant motor (which occurs 45 minutes after release from the shuttle when the perigee is reached) and release of the payload.

The technologies utilized for the design of the motor are of particular significance. This is the most advanced motor available at a European level (EBM [electron beam machining] configuration and with a Kevlar casing). In addition, it will be possible to develop this motor further and to use it as an apogee motor for satellites in the Ariane 5 class.

Technically advanced design criteria have also been applied to the development of the structure of the "cradle" of the ASE module and its mechanisms, as well as to the development of the "spinning table," whose dimensions and characteristics are unsurpassed in Europe.

No less sophisticated are the designs of the on-board avionics and of the electricity supply systems.

1.2 Participation by Industry

The orders awarded to industry for this program are described below:

- --Aeritalia: prime contractor for the ASE (Airborne Support Module) and for systems activity; responsible for the structural and temperature control subsystems;
- --Snia/Bpd: prime contractor for the ISS (Iris Spinning Stage) propulsion module; responsible for the SRM [solid rocket motor] perigee motor and for the nutation control subsystem;
- --Laben: on-board data handling subsystems, electronics for nutation control and the equipment for the electronic ground support equipment (EGSE);
- --Fiar: responsible for the electricity supply subsystems (including the distribution and control system);
- --Microtecnica: responsible for development of the "spinning table" subsystem.

1.3 Contractual Position

The contractual position for the Iris program is given below (the costs are shown in billions of lire calculated at end-1985 prices):

Phase	Description	Contractor	Cost
Launch	Booking of launch	NASA	0.12
B	Telemetering	BPD	0.13
B1	Prel. design	BPD	3.84
B2	Design	AIT	9.22
C1	Development ASE	AIT	27.77
C1	Development ISS	BPD	22.75
C2/D	Construction ASE	AIT	59.33
C2/D	Construction ISS	BPD	36.81

1.4 Status of the Program

The program now is in the construction phase (C2/D). The terms of the two contracts stipulated for this phase, with Aeritalia and Snia/Bpd as the prime contractors, mean that these two companies are committed to supplying the flight prototypes, whereas the contractual commitments of the CNR are based on the financial resources available for the years 1986, 1987 and 1988.

1.4.1 Work Completed

--Construction design of the subsystems;
--System analysis;
--Construction of the "bread-boards" of the critical units;
--Construction of the complete mock-ups of the ASE and ISS;
--Construction of the units of the Structure/Temperature Model and the Electrical model;
--First series of STS interface tests at NASA-JSC (SAIL tests);
--"Booking" of the environmental testing equipment (European coordinated facilities);
--Definition of all the operational programs;
--Construction of the MGSE (Mechanical Ground Support Equipment) of the ISS;
--Construction of all the equipment necessary for manufacturing the mechanical components;
--Construction of the EGSE-OCOE [Electronic Ground Support Equipment - Overall Check-Out Equipment]; SCOE [special check-out equipment] at an advanced stage of construction;

--Completion of purchasing of the electronic and standard flight components;
--Successful completion of the safety reviews for phases "0" and "1" with NASA.

1.4.2 Planning

According to the present contractual position, the main milestones in the program are the following:

--Start of phase C2/D	Feb 1986
--STM (Structure/Temperature Model) available	Jul 1986
--Completion of testing of the STM	Jul 1987
--Electrical models of the ASE and ISS available	Dec 1986
--Completion of testing of the system electrical models	Feb 1987
--ASE and ISS flight prototypes available	Jul 1987
--Completion of testing of the system flight prototypes	Feb 1988
--Delivery of flight prototypes with active motor	Jun 1988
--Length of launching campaign	3-5 months
--Launch date for the Lageos mission	2 Nov 1988

The above schedule makes no allowance for any possible changes which might occur in the scheduled launching dates as a result of the Challenger incident. Prior to this incident, an agreement had been reached with NASA whereby the Italian Iris system was to be considered an integral part of the launch capacity of the space shuttle, on an equal level with the American PAM-D propulsion stages. On the basis of this agreement, the documentation necessary for defining and freezing all the standard technical and operational interfaces between the Iris and the STS is now at an advanced stage of definition on a joint basis between NASA and the NSP.

The first Iris mission is scheduled for the launching of the Italian satellite Lageos II into a transfer orbit (an apogee of approximately 600 km). This mission forms part of a NASA-CNR memorandum under which NASA undertakes to supply, with no financial commitment on the part of the Italians, all the launching services relating to utilization of the space shuttle.

The second Iris mission is scheduled for the launching of the other Italian scientific satellite, the SAX. The mission of this satellite requires an extremely low, quasi-equatorial orbit.

Given the characteristics of the Iris, there appears to be considerable potential for use of this system in programs of other countries which provide for development of scientific satellites with a weight that is compatible with the capabilities of the Italian stage. All this,

however, will depend on whether or not NASA modifies its commercial policy covering use of the shuttle.

The price factor should make utilization of a system such as the Iris particularly attractive. Indeed, the size of the system (the Iris occupies one-eighth of the total available length of the cargo bay of the shuttle or, in other words, 20 percent less space than the comparable American system, PAM D-1) means that the cost of placing the Iris and its satellite into a stationary orbit using the STS is lower than with any other upper stage available on the market.

Specific initiatives are planned for the near future for more effective promotion and marketing of the Iris.

There is also considerable interest in working with the ESA to determine whether it will be possible to utilize the Iris as a fourth stage Ariane for scientific missions requiring specific orbits.

2. EGSE National Standards

A set of electronic ground support equipment, based on the ESA standards adopted at a European level, have been designed and developed as part of the Iris program. By choosing these standards, it is possible to do the following:

--To utilize expertise acquired by ESA in this sector over recent years to construct a system suitable for a variety of national programs;
--To use, with the appropriate modifications, the EGSE software developed by ESA;
--To guarantee a high degree of operational flexibility for the various units, making these interchangeable to a very great extent;
--To rationalize training of personnel and maintenance activity;
--To increase the extent to which the various parts of the EGSE can be reutilized in the various programs of the plan.

During 1985, the design and production of the EGSE standards for the Iris was basically concluded with the completion of the first set of OCOE (Overall Check-Out Equipment).

2.1 Contractual Position

The contracts awarded for the EGSE program are the following (the costs are shown in billions of lire calculated at end-1985 prices):

Phase	Description	Contractor	Cost
B/C	Construction	Laben	5.30

3. Additional Testing of an Iris Motor in a Lageos Configuration

Launching of the Lageos satellite into orbit requires the use of an Iris motor with a propellant weight 25 percent lower than the nominal weight.

In order to conduct more reliable and exhaustive testing of the Iris motor, additional testing is required (5.a) in ground simulation. The estimated cost of this testing is 1.5 billion lire, to be spent within 1986.

4. Financial Schedule

The financial schedule for development of the global Iris/EGSE program is given below:

Table 5

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
	B + C1	63.83		63.83								
	ASE	59.33				37.72	21.61					
	ISS	36.81				22.81	7.02	6.98				
	EGSE	5.30		5.30								
	(4) PROVE MOTORE	1.50				1.50						

Key:

1. Programs
2. Phases
3. Totals
4. Test. motor

5. Economic and Financial Analysis

The overall financial schedule for the Iris program includes entries whcih have been revised to allow for increase in the cost of labor and materials.

With respect to the funding provided under the 1984-88 plan, it can be seen that the costs effectively sustained for phase CD, for example, 4.69 billion lire, were higher than the original figure.

The reasons for this are the following:

--Inclusion in the Iris development program of Iris-orbiter interface testing to be conducted in the SAIL-NASA test facilities.
--Increase in the cost of using the ESTEC facilities for conducting environmental testing of the Iris system;
--Increase in the cost of the ASE/ISS and ISS/Payload separation systems supplied by McDonnel Douglas.

Lageos-II

1. Introduction

The Lageos-II program, which consists of the construction of a passive spherical satellite encased in 426 reflective optical prisms, is now in the development phase. This satellite will be used to obtain extremely precise measurements of the earth's movement in real time and of the gravitational field, using the laser ranging technique from ground stations.

Not only is the construction of the Lageos satellite of great importance for the geophysics community all over the world, but it will also represent the first payload for testing of Italy's Iris propulsion system.

The Memorandum of Understanding signed by NASA and the CNR on 7 March 1984 established the terms of cooperation for this program. On the basis of this memorandum, the Lageos mission is scheduled to take place by November 1988, and will be launched by the shuttle at no expense to Italy.

2. Contractual Position

The study phase of the program, which was directed by Aeritalia, started in 1983. The C/D phase was initiated in August 1985 and is governed by a special contract whereby the flight unit and spare parts

are to be delivered at a distance of 33 months from the date of signing of the contract.

The C/D phase, which involves testing and construction of the system, is now in its sixth month. A start has also been made on the detailed design work and some of the drawings for this have been issued. Purchasing of materials has begun and the construction of hardware has started. Construction of the mock-up of the satellite has been completed.

The 27 months that remain will be used to complete the work referred to above and to carry out the testing and acceptance campaign.

The work described above will involve considerable activity on the part of Aeritalia, acting as prime contractor, and on the part of the subcontractors Laben, Microtecnica, Snia/Bpd, MDAC and Zygo. The estimated cost of design and production is 23 billion lire.

The contracts awarded for the program are listed below. The costs are shown in billions of lire, expressed in end-1985 prices:

Phase	Description	Contractor	Cost
AB	Design	AIT	0.69
CD	Construction	AIT	24.14
CD	Land	NASA	0.66

The financing required for the C/D construction phase differs from the projection made in the 1984-88 financial plan. The reason for this is that substantial technical modifications have been made to the configuration so that the STS /Iris system can be used for placing the satellite in orbit.

Costs have also increased because of inflation.

3. Operations for the Iris/Lageos Mission

The estimated cost of the launching operation (from transportation of the flight units and support equipment to the Kennedy Space Center up to the time of liftoff, and for coverage of the stations) is 10 billion lire as of December 1985).

This figure can be broken down as follows:
--1986 = 2.0 billion lire
--1987 = 2.0 billion lire
--1988 = 4.0 billion lire
--1989 = 2.0 billion lire

4. Financial Schedule

The financial schedule is shown in the table below:

Table 6

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
LAGEOS	A/B/C/D/E	25.50	25.50	.70	10.93	13.87						
IRIS/LAGEOS	OPERAZ.LANCIO (4)	10.00	10.00			2.00	2.00	4.00	2.00			

Key:

1. Program
2. Phases
3. Totals
4. Launch operation

Other Programs in Progress

On the basis of what was illustrated in paragraph 4 above, the following pages give a description of the programs that are scheduled for completion after 1990 and of the programs based on an annual budget. The following pages also include a description of the programs concerning management of the operational bases.

Satellite for X-ray Astronomy - SAX

Introduction

The SAX scientific satellite is to be used for observations of spectral distribution and variations in time of space X-ray sources, with an energy band of 0.1 to 200 KeV. From a scientific point of view, the program includes aspects that are of very great interest for modern astrophysics, for the physics of matter (black holes, neutron stars, active galactic nuclei, and so on), for the origin of the spatial background of X-rays, and for cosmology.

The entire Italian scientific community working in this sector will take part in this program. The Netherlands will also be collaborating with Italy on the program, contributing one of the on-board scientific instruments and part of the attitude control subsystem. Collaboration in this program by the Netherlands, a decision which for various reasons could only be made at the end of July 1985, testifies to the quality of the SAX satellite and to the interest expressed in this satellite at an international level.

Following a series of contacts initiated by the Italian research minister and developed by the space authorities of the Netherlands and Italy--NIVR [Netherlands Space Agency] and the NSP respectively--the government of the Netherlands approved the country's participation in the SAX program and authorized NIVR to provide immediate funding for Dutch industry to cover the work required for phase B of the program. The government also authorized NIVR to start negotiations with Italy to define the form this collaboration would take for the subsequent phases of construction of the SAX (phases C/D and E). In July 1985, this decision was communicated in writing to the Italian minister for research by his colleagues in the Netherlands, the ministers for education and for economic affiars. The NSP and NIVR subsequently drew up a Memorandum of Understanding for the work required from each organization for phase B, establishing a timeframe for negotiation of the memoranda for the subsequent phases of the SAX program, which would then be submitted to the competent authorities.

In 1984, in order to check the feasibility of the program, the NSP awarded contracts for phase A to Aeritalia and Laben for studies of the satellite (Aeritalia) and the scientific load (Laben). In parallel with this, NIVR, provided the Fokker company with financing for the phase A work covering the attitude control subsystems. The work conducted in phase A of the program has provided positive indications for the next stages of the program.

1. Participation by Industry

The work required for phase B (design definition) has been divided between the various companies in the following way:

Satellite and scientific load

- --Aeritalia: prime contractor for systems activity and responsible for the structural and temperature control subsystems;
- --Laben: subsystem for on-board data handling and scientific load consisting of:
  - --No. 1 Phoswich (sodium iodide scintillator crystal), detector operating in the 15-200 KeV energy band;
  - --No. 1 HPGSPC (high pressure gas scintillator proportional counter), detector operating in the 3-120 KeV energy band;
  - --No. 4 concentrators for X-rays, 3 of which are to operate in the 1-10 KeV band and 1 in the 0.1-10 KeV energy band;
- --S.R.U. (Netherlands): No. 2 wide field cameras, wide field detectors operating in the 2.30 KeV band;
- --Fiar: Power distribution subsystem;
- --Fokker: Power generator subsystem (solar panels)'
- --Selenia: Telecommunications subsystem;
- --Snia/Bpd: Auxiliary propulsion system;
- --Fokker (Netherlands): Attitude control subsystem (AOCS);
- --Telespazio: Interfaces between the satellite and the ground stations.

The NIVR has approved financing for Fokker for the work required by phase B for the attitude control subsystem (AOCS). This work will be carried out under the technical direction of Aeritalia, prime contractor for the program.

Ground segment

- --Telespazio: prime contractor for the work required for the ground station, data relay system and operations control center.

2. Contractual Position

The contracts which have been awarded up until now are listed below. The costs are given in billions of lire.

Phase	Description	Contractor	Cost
A	System	AIT	0.67
B	Ground segment	Telespazio	2.23
B	System design	AIT	11.94

3. Technical Characteristics

The total weight of the satellite is 900 kg. The scientific load accounts for approximately 340 kg of this total. The satellite will be placed in a low orbit at a height of 600 km with an inclination of 12 degrees to the equator by the Italian launcher Iris and using the NASA shuttle.

The S. Marco ground station in Kenya is to be used for data reception and the transmission of commands.

As the level of performance required of the satellite is extremely great, this program is of particular interest in technological terms.

The main characteristics of the satellite are the following:

--3-axis stabilization of the satellite, with the objective of maintaining the solar axis at right-angles to the solar panels within a semi-aperture cone of 30 degrees and with an extremely accurate pointing capacity (typical values for the 3 axes x-y-z are about 3-3-1 minutes of arc);
--Large-scale (300 megabits) mass memories capable of storing all the data collected during acquisition between two successive passes over the ground station;
--Data transmission speed on the ground of 1Mbit/sec. for a minimum acquisition time of about 5 minutes; acquisition capacity of scientific data at a speed varying between an average value per orbit of 50 Kbit/sec. and 100 Kbit/sec.; use of a distributed intelligence on-board data subsystem;
--An integrated electricity supply system (rechargeable batteries and extendable solar cell panels with a total surface area of 13 sq. m.) capable of guaranteeing the capabilities required even when the satellite is in eclipse; the system must be able to generate 1200 W at the end of the mission, which is expected to last 2 years;
--A high degree of thermal and structural stability which will guarantee optical alignment of the scientific instruments in variable environmental conditions;
--An auxiliary propulsion system which is integrated, for example, which is capable of performing the orbital and attitude maneuvers necessary for the mission.

4. Status of the Program and Planning

A start has been made on the work of phase B of the program, dealing with design definition. Below we give a brief description of the work completed, the work now in progress, and the work needed to complete the program:

--Work completed

Phase A

--Feasibility study of the satellite;
--Feasibility study of the scientific load;
--Preliminary configuration of the mission;
--Definition of the critical areas;
--Estimation of the total cost of the program.

Phase B

--Definition of the on-board and ground-based scientific requirements;
--System analysis and optimization;
--Preliminary definition of the specifications of the system, subsystems and GSE [Ground Support Equipment].

--Work to be completed

--Completion of phase B;
--Phase C/D - satellite and scientific load;
--Phase B/C/D - ground segment;
--Phase E1 - operations for launching;
--Phase E2 - scientific mission.

The schedule for the SAX program is the following:

Phase A	1984
Phase B	Jan 1986/Jun 1987
Phase C/D	Jul 1987/Dec 1990
Phase E1	End 1986/Beg 1991
Phase E2	Beg 1991/Beg 1993

5. Financial Schedule

The following paragraphs show the total cost of production of the SAX satellite and the ground segment, the cost of purchasing the Iris launcher and the cost of the shuttle flight. The cost of the scientific load and of phase E2 come under the heading of pure research.

The following table gives a breakdown of the costs of the SAX program, shown in billions of lire:

Table 7

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
SAX	(4) SEGM.SPAZIALE		178.44									
	A	.70		.70								
	B	11.94				11.94						
	C D	163.80					16.00	44.80	57.00	46.00		
	EGSE	2.00							2.00			
	GROUND SEGMENT		19.53									
	GROUND A B	2.23				2.23						
	GROUND C/D	17.30					3.00	3.00	7.00	4.30		
	(5) LANCIO		45.00									
	IRIS/OPER.	15.00					3.50	2.50	4.00	4.00	1.00	
	(6) LANCIATORE	30.00							3.00	9.00	18.00	

Key:

1. Program
2. Phases
3. Totals
4. Space segment
5. Launch
6. Launcher

The financial entries relating to phase B are figures which have been agreed and are therefore final. The remaining entries are based on contractual estimates produced in the course of phase A and, as such, will be subject to variation.

6. Economic and Financial Analysis

Below we show the variations that have occurred in the costs estimated in 1983 and approved by CIPE:

	Estimated 1983	Figure Today
Phase B satellite	6.4	11.9
Phase C/D satellite/EGSE	125.2	163.8
Phase B Ground segment		2.2
Phase C/D Ground segment	40.0	17.3
Phase C1 Iris and ops.		15.0
Phase E1/shuttle		30.0

The total estimated cost of phases B and C/D of the satellite at the start of phase A was 131.6 billion lire at the end of June 1983. The cost was revised in 1984 upon completion of phase A, giving a new figure of 134.9 billion lire at the end of June 1984. This increase of 3.3 billion lire was justified on technical grounds because of factors

that had emerged in the course of the more in-depth study conducted in phase A.

Finally, at the time the offer for the work of phase A was presented (January 1985), there had been a further increase of 4.8 billion lire in the total cost of phases B and C/D, thus bringing the total cost to 139.7 billion lire at the end of 1983.

Therefore, the estimated total cost of the satellite at the end of June 1983 was 139.7 billion lire, a figure which had increased to 173.7 billion lire by November 1985.

With regard to the total cost of the ground segment, purchase of the Iris vehicle and use of the shuttle, the 1983 NSP plan allocated a figure of 40 billion lire. The total cost of the work for phases B and C/D for implementation of the ground segment was 19.5 billion lire in November 1985. The figure which has already been agreed for phase B is 2.2 billion lire.

Today it is estimated that the cost of the Iris vehicle or of operations will be 15 billion lire as of November 1985. This estimate is to be regarded as reliable but only indicative. On the basis of NASA regulations, the cost of the shuttle flight for an Iris-SAX load is an estimated 30 mbillion lire, a figure which represents a variation of about 10 billion lire compared to the original estimate. This increase is essentially due to the fact that the prices of the shuttle flights have been revised and to variations in exchange rates.

Rocket Motors

Cryogenic Propellants

1. Program for a Rocket Motor Using Two Storable Liquid Propellants (BLI)

In 1985, on the basis of the results of a feasibility study commissioned by the NSP for Fiat Aviazione, it emerged that certain benefits were to be derived from the development of a rocket motor using BLI, to be utilized mainly for attitude control or for primary propulsion at low thrust.

The preliminary design of the rocket motor is now being defined. The rocket motor will be designed in such a way that it will be possible, without the need for additional costly development work at a later stage, to create a whole family of these motors capable of covering a 40 to 200 N thrust range. This is possible thanks to the acquisition both of advanced technologies such as those used on the Columbus and of

special cooling techniques. These rocket motors offer a wide range of potential applications in both the medium-term and long-term space programs, such as Italsat II, Columbus and Hermes.

The development and test program of the rocket motor using BLI is expected to be completed within the next 5 years as well as developing and, if necessary, upgrading the available test facilities.

2. Power Supply Systems Using Cryogenic Propellants

In this sector, Fiat Aviazione has initiated a feasibility study for a turbopump for liquid cryogenic propellants, implementing tests on turbine batteries. The objective of this study is to acquire basic know-how for the application of these systems not only in the short-term, on motors such as the HM-60 used on the Ariane 5, but also in the future, on motors for transatmospheric vehicles (such as the Hotol) and for use on missile systems.

Further initiatives are expected as part of this program concerning the design and testing of power supply systems using cryogenic propellants. The development of the requisite infrastructures will also be taken into consideration.

3. Financial Schedule

The overall financial schedule for the work described above is given in the following table:

Table 8

(1) PROGR.	(2) FASI	(5) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(3) PROPULSIONE	ENDOR.+CRIOG. (4)	49.42	49.42			2.42	8.00	10.00	16.00	9.00	4.00	

Key:

1. Program
2. Phases
3. Propulsion
4. Rocket motor + cryogenic propellants
5. Totals

Environmental and Terrestrial Observations

The NSP is particularly concerned with terrestrial observation programs, both concerning the location of the Earth's resources--and, on a more general level, of all kinds of environmental resources--and in connection with geodetic observations. The study of the Earth's resources, which has been in the preoperative stage for quite some time, is by now ready to meet the demands of a business market, or will be so in the very near future.

Geodetic surveys are playing an increasingly important role in the study of the movements and shapes of whole continents and are proving indispensable for a proper assessment of the causes of seismic phenomena throughout the globe.

1. Telesurveillance

A number of telesurveillance programs, covering a wide range of activities both in the space and in the ground segments, are currently being implemented along the lines of the 1984-1988 revised plan. The programs, which on the whole fit in well with Italy's ESA projects in the sector and are consistent with the lines of action that are currently being pursued worldwide, relate to:

--New sensor-operated systems in the field of microwave technology for carrying out high-definition surveys regardless of weather conditions (Sensor technology);
--High-efficiency systems for preprocessing the data gathered through such telesurveillance (advanced architecture systems);
--Dataprocessing methodologies for environmental applications (pilot project).

1.1 Sensor Technology

1.1.1 Synthetic Angle Radars (SAR-X)

Following the guidelines set out in the 1984-88 revised plan and the correspondence between the DFVLR [German Experimental Institute for Aeronautics and Astronautics] and PSN of 18 December 1985, a cooperation program with the FRG is under way in order to develop an X-band Synthetic Angle Radar (SAR) to be installed aboard the Shuttle along with L-and C-band sensors, as part of a NASA mission referred to as SIR-C and scheduled for 1889.

The main objectives of the SAR-X project concern a systematic analysis--to be supplemented with the data provided by the other SIR-C elements--of the influence of frequency, polarization, and off-nadir

angles on different settings for prospective applications in the fields of geology, hydrology, vegetation, oceanography, and so on.

The SAR-X system is made up of a sensor and a terrestrial segment. The sensor is a vertical polarization, 9.6 GHz frequency, X-band synthetic angle radar, specially designed to perform earth observations from space. The radar will be placed at a nominal attitude of 255 kms from which it will illuminate ground areas ranging between 12 and 47 kms in width, with corresponding off-nadir angles ranging from 15 to 60 degrees.

The project is still in the design stage, which is expected to last until the end of 1986. Selenia Spazio, along with Dornier Systems, is responsible for the industrial development of the entire system. More specifically, as regards the development of the B2 phase, Selenia Spazio is responsible for the electronic design of the aerial, the ground support equipment and, in conjunction with CONTRAVES, the RFE and FE [expansions unknown].

A particularly important feature of the project concerns the activities developed in connection with the terrestrial segment. The data picked up by the SAR will be recorded on a special tape aboard the Shuttle, while part of the data will be sent to a ground station and thereby processed in real time by a special "survey processor." Once the mission is over, the tape recorded data will be handed over to the scientific community in order to be processed to produce sharply defined images of the illuminated surfaces.

The very complexity of the SAR-X program is a factor of critical importance both from the industrial and from the technological points of view, in that it offers our domestic industry a valuable opportunity to increase its know-how in a strategic sector. It is also worth emphasizing that these activities are fully consistent with the industrial projects developed in the framework of the ESA, in connection with the ERS-1 mission.

The funds allocated up to 1985 amounted to 3.28 billion lire, subdivided as follows:

--1985	1.40 billion
--1985	1.88 billion

The funds allocated to each contractor are shown in the following table (in billions of lire):

Phase	Description	Contractor	Allocation
O	feasibility	CISE	0.40
A	"	AQUATER	0.15
AB	SAR System	SELENIA	0.70
B	SAR-X	"	1.88

As for its prospective development, the program is expected to reach the implementation stage in the near future. The definition of a more precise schedule depends on the cooperating parties (DFVLR and NSP).

Looking at the matter from this perspective, there seems to be no doubt that a large number of industries will be asked to take part in the program, with Selenia Spazio having overall responsibility for the system.

At present the funds required for its implementation are estimated at some 23 billion lire, to be allocated as follows:

--1986	5.90 billion
--1987	10.00 billion
--1988	8.00 billion
--1989	2.00 billion

1.1.2 Sensor Development in the Visible and in the IR Ranges

While technological and applicational factors demand that priority be given to the development of microwave sensors, the optical field (both in the visible and in the infrared ranges) should not be overlooked. On the one hand, there is a definite need for our industries to acquire wide-spectrum systems engineering techniques; and on the other, the interpretation of microwave measurements calls for some kind of combination with opical band measurements. It is indeed difficult to consider a mission complete unless all the bands are used in combination.

At present the most promising lines of development are:

--The linear arrays of detectors which, due to their considerable integration time, offer high-definition geometric displays for applications in land and ocean surveys;

--Interferometers which, because of their high spectral definition, are most suitable for investigating the vertical thermal structure of the atmosphere as well as atmospheric pollution.

The relevant financial resources are expected to be allocated as follows:

--1990	1.00
--1991	5.00
--thereafter	20.00

1.1.3 Microwave Radiometer

A feasibility study has recently been undertaken in connection with the development of a passive microwave radiometer to be installed on polar platforms for ground observation after 1993. The radiometer will be utilized in order to assess the following parameters:

--Sea surface wind/sea state
--Intensity of precipitation (on sea and on land)
--Soil moisture
--Fluid water and steam content in the atmosphere
--Snow melting processes
--Surface temperature of the sea
--Extent and age of oceanic ice formations.

The radiometer will orbit at a height of approximately 850 kms and will ensure overall coverage (day and night) with data recordings in 5 frequencies (ranging from 5 to 40 GHz), all of which are achieved through double polarization. Geometric definition ranges between 5 and 40 kms depending on frequency, while the value established for radiometric definition is 0.5K.

The passive microwave radiometry sector is extremely interesting from the technological-industrial point of view, since the effective promotion of the NSP projects at the industrial level enables the domestic industry to increase its know-how and to strengthen its position vis-a-vis its competitors in any bidding which may be called for by the development of the meteorological satellites of the next generation.

For the time being, phase A is in progress, and is expected to be concluded no later than 1986.

The study is being carried out by Selenia Spazio in cooperation with SMA and implies the development of a preliminary project, centered on the characteristics of impact on the platform (weight, overall dimensions, required power, etc.) and on the integration of the radiometer on the platform itself.

More specifically, Selenia Spazio is responsible both for the aspects connected with space technology and interfacing and for the development project of the "aerial" and "digital section" subsystems; SMA is in charge of sensor engineering and the receiver subsystem.

The funds allocated for the development of this project are estimated at 21.5 billion lire, to be divided as follows:

--1987	0.50
--1988	1.00
--1989	2.00
--1990	9.00
--1991	9.00

1.2 Advanced Architecture Systems

A number of projects are under way in this sector, concerning both the acquisition and preprocessing of data and data display.

1.2.1 SAR Data Preprocessing System

Because of the ever more pressing need to process the huge amount of sensor-gathered data at increasingly accurate levels of definition, a preliminary study is being carried out on a data preprocessing system, a prototype of which is expected to be developed by the end of 1988.

The system, which is based on EMMA-type multiprocessor architectures (Elaboratore Multi Mini Associativo), will be used to pretreat the SAR data gathered by the ERS-1 satellite under actual operating conditions.

EMMA is based on a modular-structure design, which makes it possible to increase its calculation capability considerably. In its present configuration, the system features two families of processors connected to the same bus, hence processing the data simultaneously.

The development of a system prototype is currently in progress. The the entire data preprocessing system is to be developed under the responsibility of Telespazio, with Elsag playing a minor role.

The contractual and financial aspects of the projects may be summarized as follows:

Phase	Description	Contractor	Allocation
A	Preliminary Project	Telespazio	0.58
B	Data Processing	"	1.03
CD	SAR-EMMA	"	5.72

The 1985 budget relates to the entire program, which is expected to be carried out by 1988.

1.2.2 Graphic/Pictorial Video System

A program is well under way for the design and development of a domestically produced hardware and software system capable of competing with the best units of the kind on an international level and offering high local computing capability for interactive image processing.

The EIDOBRAIN 7001 hardward structure by VDS was selected in order to establish a graphic-pictorial work station for the development of images in the telesurveillance and astronomy sectors, by developing necessary systems of firmware and software. The first part of the program, which has almost been completed, concerns the implementation of the firmware and the development of the basic software and of the environment concerning the host computer. The main concern in this area is to optimize the management of the EIDOBRAIN 7001 unit by supplementing it with a Motorola 68000 processor.

The project is to be developed by VDS (Video Display System), the company which manufactures and markets the EIDOBRAIN 7001 system.

The funds allocated up to 1985 amount to 1 billion lire. An additional 1 billion lire is expected to be allocated in 1986 for the full implementation of the project.

Project-funding in the advanced architecture sector may be summarized as follows:

--1985	2.05
--1985	5.73
--1986	0.50
--1987	2.50
--1988	2.00

1.3 Pilot Project

The objective of the Telesurveillance Pilot Project is to develop specific products on the basis of remote-recorded data for immediate application in the agro-hydro-geological, oceanographic, and marine resource sectors.

Phase A focused on the following areas of interest:

--Land coverage maps
--Snow/water equivalence
--Soil moisture
--Ground surface temperature
--Wave motion characteristics
--Sea surface temperature
--Chlorophyll and suspended sediments.

In phase B, the more technologically mature areas (land maps and sea surface temperature) were singled out for the development of prototypes; at the same time, the need was felt to carry out research activities in order to gain additional know-how for the production of the other areas.

Project work in the first year of phase C, which has just been completed, centered on the development of specific designs for the mature areas, and triggered new research into those areas for which medium or long term feasibility prospects exist.

Phase C, which is expected to take 3 years to complete, is aimed at achieving the following results:

--As regards the coverage maps and the sea surface temperature area, the development of an operating prototype, possibly to provide a basis for industrial production;
--As regards wave motion, the development of a preoperative utilization project (in particular for the data that will be gathered by the ERS-1 satellite, to be launched by ESA in 1989);
--As for the other areas, major studies and research projects are to be carried out in order to assess their feasibility, especially in connection with prospective scientific and applicational requirements.

Specialized firms (Telespazio and CSATA) as well as research institutes and laboratories contributed effectively to the implementation of the project as a whole. The former were responsible for engineering those geophysical parameters that had already been assessed as feasible and for developing a hardware/software prototype for the multidisciplinary management of the telerecorded and auxiliary data. The scientific community, on the other hand, contributed to the project both by providing industry with the necessary informational input and by developing coordinated research activities on specific topics in order to provide a sound basis for the production of prototypes of those areas that are not mature by today's technological standards.

The funds allocated up to 1985 amount to 7.99 billion lire. The pilot project, which is to be carried out by 1988, will lead to the establishment of a new frame of reference which, along with the data

made available by the sensors to be employed in future missions, is expected to result in the definition of new activities centered on those areas that at present are critical in terms of the relevant applications. The funds, to be allocated over the next 6 years (up to 1991), amount to some 12.4 billion lire, as shown below:

--1986	3.40
--1987	3.30
--1988	3.30
--1989	2.00
--1990	2.00
--1991	2.00

1.4 Development of Preparatory Activities

A number of preparatory activities designed to complement the main activities promoted by the ESA are being developed on a national basis in order to ensure the overall consistency of the Space Plan with ESA's fast-developing projects in the telesurveillance sector. One such example is the EOPP program (Earth Observation Polar Platform), which is intended as a preparatory step toward a special program which may be viewed as a natural extension of the research projects currently pursued in the area of advanced architectures. These projects are also expected to provide a suitable background for the potential developments of the applicational and integrative aspects of the pilot projects and of the medium and long term programs envisaged by the European plan.

The estimated budget for this line of activities is as follows:

--1987	1.00 Billion
--1988	1.00 "
--1989	1.00 "
--1990	1.00 "
--1991	1.00 "

Budget Schedule

Financial support in the telesurveillance sector is expected to comply with the following schedule:

Table 9

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) TELERILEV.			98.45									
	(5) PROGETTI PILOTA	23.99		7.19	.80	3.40	3.30	3.30	2.00	2.00	2.00	
	(6) SAR-X(HARD/SOFT)	29.18		1.40	1.88	5.90	16.00	8.00	2.00			
	(7) ARCH.AVANZATE	12.78		2.05	5.73	.50	2.50	2.00				
	(8) MW RADIOMETER	21.50					.50	1.00	2.00	9.00	9.00	
	(9) VISIB.INTERFEROM.	6.00								1.00	5.00	20.00
	(10) SVILUPPI	5.00					1.00	1.00	1.00	1.00	1.00	

Key:

1. Program
2. Phases
3. Total
4. Telesurveillance
5. Pilot project
6. SAR-X (Hard/Soft)
7. Advanced architectures
8. MW Radiometer
9. Visible interferometer
10. Developments

2. Space Geodesy

The Space Geodesy program entails a number of advanced activities in connection with the design and development of suitable systems (laser-ranging, VLBI, GPS) for the observation of the Earth in terms of a cinematic survey of continental plates and a description of the global motions (rotation, polar motion). The project implies specific operations both in the space and in the ground segments. As for the former, a special satellite is being developed (LAGEOS II).

At the same time, other activities connected with the feasibility of these systems are in progress, the main emphasis being on our country's geographical characteristics and interests. The Space Geodesy program (which is being developed on the basis of an international cooperation agreement involving the United States, West Germany, and the Netherlands) is mainly targeted at the establishment of a dedicated

station at Matera (see also the section devoted to management). While the Matera station has been operating since July 1985, its activities are restricted to laser-ranging since the expansion of VLBI systems is expected to take another 2 years to develop. Over the last few months, the station has reached its full operating capability, acquiring more than 1,000 geodetic interfaces (LAGEOS, STARLETTE) and establishing itself as one of the world leaders in terms of scientific-technical efficiency.

An NSP-NASA agreement covering a wide range of activities in the Geodetic sector is already in force. Other agreements have been signed with IFAG (the European Consortium for Geodesy) and with the University of Delft (Netherlands) for the development of the Wegener campaign.

As for the Matera station, a cooperation agreement with the Basilicata regional council has been reached, according to which the NSP is responsible for the technical-scientific aspects of the operation while the regional government is responsible for development of the necessary infrastructures.

2.1 Long-Range Interferometry

Work is in progress for the design and development of a VLBI aerial and of the relevant apparatus. The aerial, which measures 20 m in diameter, is intended for space geodesy and radioastronomical applications within the 30 GHz range.

The system, which is to be installed at the Matera geodetic station, is also designed to operate with other systems of the kind to compare its results against those obtained with laser-ranging techniques. Moreover, a time base and a frequency standard (MASER-H) are indispensable for operating the new system, which also features a high-speed recording apparatus, referred to as MARK-III.

To give the reader a rough idea of the project's time schedule, let us recall that phase A/B took 1 year to complete (July 1985) and called for a financial investment of 1.51 billion lire. The contracting companies involved in each phase of the project are listed below:

Phase	Description	Contractor	Funds Allocated
0	System Study	Telespazio	0.17
AB	System Development	Selenia	1.10
AB	Experiment	CNR + Universities	0.24

At present, the project is well into phase C/D, which is expected to take 2 years to complete; this means that the system will be operational by 1987.

As for the role played by industry in this project, Selenia Spazio is expected to be the main contracting party and to be in charge of the development of the optical and electronic part of the system, while SAE, a subcontractor, will be responsible for the design and control of the aerial.

The funds needed for completing the project are estimated at 11.50 billion lire, to be subdivided as follows:

--1986	8.00
--1987	3.50

2.2 Laser-Ranging System

This program relates to the development of a high mobility laser-ranging system for periodic surveying of special sites both in Italy and abroad, and is part of a wider cooperation program with other agencies using similar systems. The main part of the laser unit is to be slightly modified in order to replace the LR system currently used at Matera. The new system will be equipped with a YAG neodymium laser, with a laser pulse repeating frequency of up to 15 hz. The instrument's degree of accuracy on each feedback is approximately 1 cm.

The program, which was started in 1983 with phase A1, has been developed with the industrial participation of CISE. The funds allocated for this phase of the project totaled 0.17 billion lire.

Phase A2/B is currently in progress, and is expected to take some 8 months to complete. CISE is the prime contractor in charge of the industrial development of this phase of the program, which entails the development of the laser and of the electronic surveying instruments. Other companies cooperating in this program are: Fiar, for the design of the data-recording system; Selenia Spazio, which is responsible for the development of the system's hardware and software; and Officine Galileo, which is in charge of the optical and aiming systems. This is to be followed by phase C/D, in which a first preoperative unit will be manufactured and installed at Matera by the end of 1984 [date as published]. The production of a final model, marking the end of phase C/D, is scheduled for the end of 1988.

Future investments in this area are estimated at 5 billion lire, as follows:

--1986	2.70 billion
--1987	3.00 "
--1988	2.00 "

2.3 GPS Technique Development Program

This group includes those studies and products that are specifically designed to provide a basis for the development of Space Geodesy measurement systems based on satellite system radio reception (for example, NAVSTAR and PRARE). These systems, which have a degree of accuracy of ± 1 cm on baselines measuring up to 300 kms, are indispensable for enhancing the measurements obtained with laser and VLBI techniques. As these systems are most likely to become commercial navigation and positioning systems, the acquisition of a specialized knowledge of the relevant manufacturing technologies by the domestic industries seems all the more important at this time.

An initial feasibility study to be carried out by 1986 should be followed by detailed planning and by the development of bread boards in 1987, while the first preoperative units are expected to be ready by 1988.

The mechanical and optical characteristics of the system designed for VLBI applications are of considerable interest for prospective applications in other areas as well, for example, monitoring and interplanetary probe control. At present, this type of probe is guided by NASA's Deep Space Network stations (DSN).

A feasibility study of the modifications which may be introduced to the VLBI project for prospective applications in the above areas would be of considerable significance for a number of reasons, including the limited number of such stations, NASA's desire to establish additional DSN stations in the Mediterranean, and the growing interest in interplanetary missions expressed by the European countries. Essentially, these alterations should entail a relaxation of the optical requirements and an increase in the size of the aerial by doubling its diameter (from 20 to 40 meters). The total cost of the operation is estimated at some 7 billion lire.

The finanical aspects of the project may be summarized as follows:

--1986	0.50 billion
--1987	0.50 billion
--1988	1.00 billion
--1989	2.50 billion
--1990	3.00 billion
--1991	3.00 billion

2.4 Scientific Activities

The NSP is carrying out a systematic research program centered on the development of measuring instruments. The program, which is being implemented with the aid of the national and international scientific community, utilizes the data provided by OGB mobile laser instruments.

In this connection, these different lines of action are being pursued:

--Delicate Orbitography
--Geophyscial data analysis and interpretation
--Survey methods and techniques.

As a result, a number of research projects have been undertaken in this sector at a cost of approximately 0.6 billion annually. These activities have enabled the scientific community to gain insight into several of the problem areas dealt with by the large-scale international programs, such as NASA's Crustal Dynamics and the Merit program in the area of polar motion.

While these scientific activities have so far been associated, in financial terms, with the management of the Matera station, their future development is to be related to the financial allocations made in the area of basic science (an estimated 2 billion lire per year).

2.5 New Technologies

An overview of the international scene has led to the identification of some specific lines of action which, through the relevant feasibility studies, should offer a sound basis for the development of targeted programs.

The activities scheduled for the 1986-88 period include:

--The development of a laser-ranging system based on a totally new design (multifrequency) as well as on the employment of new technologies such as alexandrite laser sources.
--The preliminary and advanced project (Phases A/B) of an aerial based on the design of the geodetic VLBI, to be employed in the framework of NASA's Deep Space Network.
--The study, to be carried out in cooperation with NASA, of a LAGEOS-type mission offering suitable characteristics for the implementation of general relativity experiments.

From the financial point of view, these areas of activity--which are considered important for the development of Space Geodesy programs--are to be ranked among the studies and research projects carried out for prospective applications.

2.6 Measurement Campaigns

Besides the Matera station, where long baselines and large-scale motions are currently being studied, other sites have been identified for the study of various types of motion on a regional basis. The sites, which have been selected on account of the geodetic and logistic opportunities they offer for the establishment of mobile stations, include Cagliari, Trieste, as well as others in Sicily and Tuscany for which no definite plans have yet been developed.

Important measurement campaigns for the acquisition and correlation of data from a scientific point of view are to be carried out in connection with the Wegener campaign (participating countries include West Germany, the Netherlands, Greece, Switzerland, the United States and Italy).

The financial aspects of the project may be summarized as follows:

--1986	0.87 billion
--1988	1.00 billion
--1989	1.00 billion
--1990	1.00 billion
--1991	1.00 billion

Budget Schedule

The overall investment situation in the Space Geodesy sector is shown below:

Table 10

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) GEOD.SPAZIALE			36.25									
	(5) VLBI	13.01		1.51		8.00	3.50					
	(6) LASER MOBILE	7.87		.17		2.70	3.00	2.00				
	(7) GPS - DSN - strum.	10.50				.50	.50	1.00	2.50	3.00	3.00	
	(8) CAMPAGNE DI MISURA	4.87				.87		1.00	1.00	1.00	1.00	

Key:

1. Program
2. Phases
3. Totals
4. Space Geodesy
5. VLBI
6. Mobile Laser
7. GPS-DSN-instrum.
8. Measurement Campaigns

Basic Research

1. Introduction

The goals pursued by the plan in the Basic Research (Space Science) sector are mainly:

1) To enable the research institutes and domestic industries operating in the space sector to retain a sufficiently high degree of competitiveness on an international level as regards the experimental aspects and the development of advanced, innovative instruments to be used for basic research, and to promote the development of sophisticated technological and managerial skills through the introduction of large-scale national programs.
2) To ensure that the ESA programs (which are partly financed by Italy as a member-state) are effectively supported by the scientific community both as regards the development of the instruments to be fitted on board and in connection with the utilization of the data supplied by observation satellites.
3) To enable the scientific community to take part in any international cooperation program that may be of particular interest, regardless of whether it is developed by the ESA.

A highly structured participation plan, involving laboratories, the CNR, and university centers as well as industries, has been developed along these policy lines.

2. Industrial Participation

The main industrial contracts awarded in the Basic Research sector are shown in the following table (the relevant allocations are in billions of lire):

Program	Phase	Firm	Allocation	Year
SAX payload	A	Laben	340	83
GAMTEL	BC	Laben	533	83
	BC	Laben	165	84
	D	Laben	372	85
GIOTTO	D	Laben	518	81

	D	Laben	69	84
GIOTTO	B	Galileo	228	81
	C	Galileo	720	82
	D	Galileo	8	84
	D	Galileo	24	84
GIOTTO	BC	Gavazzi	316	82
	D	Gavazzi	117	84
TETHER	C	Gavazzi	399	85
	C	Gavazzi	563	85
	C	Gavazzi	298	85
HIPPAR.	C	CSATA	477	85
	A	CSATA	98	83
	C	CSATA	141	84
HYPPAR.	C	CSS	300	83
	A	CSS	216	82
	C	CSS	880	85
TETHER		NASA	206	85

3. Description of the Activities

While until fairly recently the main focus of the space sciences was an astrophysics, the revised plan covers a wide spectrum of activities centered on the development of earth and life sciences. Indeed, in recent years these disciplines have attracted considerable interest, especially as a result of the development of gravity-free experiments and of earth observations.

On the whole, the space science programs will be organized along the same lines as were established by the former plan, to include:

--A "National Program" consisting of those research programs that are to be implemented and managed first and foremost by Italian research institutes and industries.
--An "ESA Program" relating to Italy's contributions to the scientific programs developed by the ESA.
--An "International Program" including all the other scientific activities developed on the basis of international cooperation.

There are two items which play a pivotal role in each of these programs:

a) Development of flight instrumentation
b) Study and development of flight instrumentation prototypes for prospective development programs, and analysis of the data recorded by such instruments during operation, priority being granted to those programs that are funded (either directly or through the ESA) through Italian contributions to the development of these instruments.

Activities in the basic research sector are, by their very nature, largely dependent on the projects developed by the ESA as well as by other international space agencies.

Therefore, these activities cannot be planned independently on a national basis, but call for a structured plan to ensure consistency with the decisions made at the international level.

National Program

A preeminent aspect of the National Program relates to the completion of the SAX satellite, which is to be put into orbit by 1990-91. The SAX program, in which industry is to play an increasingly smaller role beginning in 1988-89, is closely related to the implementation of another program for a new scientific mission involving a number of problem areas which Italy's scientific community has long been ready to tackle: a special advisory team, similar to the one established by ESA, should help identify specific projects, a first selection of which should be made available by 1989. The estimated financial requirements are based on the following sequence of steps: performance of feasibility studies in 1988, A-phase studies on a number of programs by 1989, a B-phase study on the actually selected program by 1990.

While this new program offers the various national space research sectors the opportunity to "take turns," as it were, in the development of large-scale projects, it is also designed to ensure the preservation and development of the technological and management skills acquired by Italian industry. The implementation of this program is made all the more important by the prospective utilization of the future space station for scientific purposes. A point which deserves to be considered, however, is whether this venture, while organized and directed on a national basis, should be carried out with the scientific and financial support of other countries or not.

A number of research projects are being considered in the area of stratospheric balloons. The relevant financial requirements have been estimated on the basis of an average of 4 balloon launches a year, which means that 7 or 8 research teams are to be employed at the same time. The growing involvement of some of these teams in the development of the SAX satellite is expected to lead to a reduction in the number of X-ray astronomy research programs currently carried out by balloons. On the other hand, research activities are expected to undergo a considerable boom in those areas in which significant breakthroughs have been made; these include: IR astronomy, deep space measurements, earth and life sciences, and so on.

ESA Program

Over the last 2 years the ESA has developed, as part of a general planning process, a specific program designed to boost research operations in the space science sector. The program, known as Horizon 2000, covers the years from 1985 up until 2004. The ESA Council, which met in Rome on 30-31 January 1985, approved a preliminary draft of the proposed plan and the governments of the member states endorsed the proposed increase in the amount of resources to be allocated to the space sciences--an additional 5 percent a year until 1989. The entire situation will be reconsidered in 1987, when the representatives of the various countries meet again to discuss the ESA's request to retain a 5 percent annual increase in the contributions of the member states until the 200 MAU [million accounting units] mark is reached in 1994. Besides the space science program, which is part of a compulsory scientific program, the ESA will also carry out other activities in the area of earth and life sciences.

As a result of the new plans developed by the ESA, the representatives of the participating bodies had to reconsider the whole system designed to provide the necessary financial support to the research teams which are already working on specific projects or which are expected to be involved in the ESA's future scientific programs.

A rough estimate of the financial resources required for the scientific instruments was made on the assumption that each scientific space vehicle developed by the ESA will be used to carry, on average, one experimental project developed and implemented in Italy and that the total cost should be roughly equal to the percentage correspoonding to Italy's financial contribution to the compulsory program. Due consideration was paid both to the pending programs (Giotto, Ulysses, Hipparcos, ISO, STP) and to a considerable number of other programs (which are to be approved within the next 5 years according to the ESA budgeted expense plans) among those which are still in the preliminary phase (Eureca, and at a later stage, Kepler, Cassini, Agora, XMM, First, Lyman, Quasat).

The estimated financial allocations include the development of new flight instruments for future programs as well as the necessary contributions for participating in the operations and data analyses involved in the observation programs that are now in progress or are about to be started (IUE, Exosat, Space Telescope) and in future ESA earth science and life science programs.

International Program

A cooperation project involving Italy and the United States is to play a major role in this program over the next 5 years. The project hinges on a number of experiments to be carried out on board during the first TSS (Tethered Satellite System) flight and on the development of the necessary instruments for a second TSS flight.

Funds are to be allocated also for study and participation in scientific experiments on the space shuttle and for new missions to be defined in the near future, such as International Solar Terrestrial Physics (ISTP), Cometary Rendezvous Asteroid Flyby (CRAF), the Mars Observer Mission (MOM), and NASA's Galileo project, the Franco-Soviet VESTA mission as well as others, including those which pertain to the earth and life sciences.

4. Economic Analysis

A comparison of the figures set out in this plan (see table 1) with the ones included in the 1984-88 plan readily shows that the average annual expenditure has risen from 9.2 billion lire of mid-1983 (1984-88 plan) to 20 billion lire of November 1985 (1987-91 plan).

Part of this increase is to be attributed to a change in economic conditions; thus, a more accurate assessment of the average yearly expenditure recorded in 1983 would put the figure at approximately 11.5 billion rather than 9.2 billion lire.

The rest of the increase (roughly 8.5 billion per year) totaling 42.5 billion of the 5-year period, concerns the following:

--7 billion to be devoted to the SAX program; more specifically, to the preparatory activities which are necessary for data acquisition and analysis by the relevant institutes, and to operations management during the first year following the launch of the satellite;
--5 billion to be allocated for research work involving the use of stratospheric balloons; a considerable part of this increase is due to the rising cost of the balloons themselves. A realistic evaluation of the research activities carried out with balloons also indicates that a reduction in the financial resources allocated to this area by the new plan might cause the relevant agencies to discontinue these activities on a national basis, just at a time when the international community is taking an interest in the availability of a launching base in the Mediterranean.
--7 billion for the study and implementation of Phase A of a new mission, to be carried out primarily on a national basis; these funds are to be used for the most part toward the end of the 5-year period;

--5 billion for the development of feasibility studies relating to technologically innovative flight instruments; these studies are not connected with programs of immediate interest, but are designed to provide a basis for Italy's participation in future international space projects;

--10 billion to be allocated to the study and development of scientific equipment to be used aboard satellites, platforms, and space stations; this increase is to be attributed both to the expected rise number of ESA in the programs that are to be implemented over the 5 years (in accordance with the international agreements referred to earlier) and to the higher degree of technological complexity involved in the individual experiments. An additional reason is the widening scope of the scientific community, which is starting to take an active interest in the hitherto marginal aspects of the space sciences;

--2 billion to be allocated for the continuation of the activities connected with the TSS, in addition to the previous plan's allocations;

--6 billion to be allocated to the bilateral operations program. Besides the TSS project, the relevant parties are also planning to take part in future interplanetary missions to be carried out in cooperation with other nations (not necessarily ESA members) and in experiments aboard the shuttle.

5. Budget Schedule

The estimated financial requirements for the 1987-91, 5-year period for a balanced development of the Basic Research program are summarized below (in billions of lire, based on economic conditions as of December 1985). The data have been broken down according to the fields of scientific activity.

The space science item includes the expenses concerning the scientific payloads for the two programs (SAX and Tethered) in which Italian industry is to play a major role.

The following table shows the trend of the estimated costs involved in the implementation of these programs and offers some indication of the expenses that have already been incurred.

Table 11

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) RICERCA BASE		45.19	149.98	22.92	7.47	14.80						
	SPACE SCIENCE	48.00					4.90	6.50	8.80	12.80	15.00	
(5)	SCIENZE TERRA	8.50					.50	2.00	2.00	2.00	2.00	
(6)	SCIENZE VITA	4.50					.50	1.00	1.00	1.00	1.00	
	PAYLOAD TETHERED	10.47			1.47		1.00	2.00	2.00	2.00	2.00	
	PAYLOAD SAX	33.32				3.32	4.00	4.00	6.00	10.00	6.00	

Key:

1. Program
2. Phases
3. Totals
4. Basic research
5. Earth science
6. Life Science

This is the first time that specific allocations are made for earth and life sciences. Previously, the funds allocated for the activities carried out in these fields were simply referred to as basic research, but the increasingly important role played by these activities requires that they be accounted for under separate headings.

Technological Research

Introduction

The main object of this program is to promote and implement technological research and development initiatives in view of medium and long term space missions.

The lines of action currently pursued by the NSP are structured as follows:

--Space telecommunications
--Space propulsion
--Robotics
--Mechanical technologies
--Electronic technologies
--Microgravity

1. Space Telecommunications

This line of operation is centered on research activities in the field of satellite telecommunications.

The NSP has been funding studies and research projects by university and CNR institutes on airborne antennas, radar reflection measurements, multiple access techniques, communications protocol analyses, and the effects of high frequency wave propagation. In particular, the NSP has contributed signficiantly to the research and development efforts made to improve the scientific equipment currently used by the experimental station located at Spino d'Adda. The station, which is managed by the CSTS/CNR, is designed to carry out high frequency propagation experiments with the ESA satellites.

The following table includes the allocations made to the various contractors involved in the space telecommunications project:

Phase	Description	Contractor	Allocation
BC	Research program	Universities	.397
BC	Research program	CNR	.561
A	Telecommunications program	FUB	.098
C	Monomic	Italtel	5.000
A	Monopulse	Telespazio	.031
A	Unified proposals	Telespazio	.070
A	Cluster	CNS	.198

2. Space Propulsion

This line of action is aimed at promoting research and development activities in the field of space propulsion both through public research institutes and through industry.

--"Feasibility Study for an Organic Propulsion Program." This study, which was carried out by SNIA-BPD, provided the ground work for an organic research and development plan involving public research institutes and industrial laboratories.

--"Research in the Field of Space Propulsion." A 2-year research contract is in effect with SNIA-BPD as the prime contractor. According to the agreement, research is to be carried on in four specific areas: solid propulsion, liquid propulsion, electric propulsion, and related fluid dynamics research. Subcontractors include Fiat Aviazione and a number of public research institutes.

--"Endoreactor Study." This study, carried out by Fiat Avio, focused on the preliminary activities for the development of storable liquid bipropellants Endoreactor.

The allocations made in the space propulsion sector are shown below:

Phase	Description	Contractor	Allocation
0	Endoreactor	Fiat	.159
0	Prop. Feasib.	BDP	.058

3. Robotics

Having recognized the importance of supplementing the overall plan with a program specifically devoted to the applications of robotics to space activities, the NSP decided to provide the necessary financial support for the following studies in the attempt to single out specific areas for prospective development:

a) "Overview of Space Robotics." This study, which was carried out by Fiar, centered on an analysis of present and future space missions featuring robot-operated activities, components identification, and a review of the leading suppliers of products and services.

b) "Study of Specific Applications in the Field of Space Robotics." This study, carried out under the direction of Selenia Spazio, was based on a survey of space robotics missions and included a general study of automation systems. Two different types of mission were identified: visual and thermal IR inspection; telemanipulator servicing.

Robotics are bound to play an increasingly important role in space technology over the next few years. The growing complexity of the space systems and the presence of semipermanent orbital stations, whether inhabited or not, call for the development of specialized skills both in the assembly and in the supply of components and materials. As these operations cannot always be performed directly by man or under his constant supervision, they must be carried out by systems with a high degree of operational and decision making flexibility.

A certain number of areas of special interest have already been identified, namely:

--Systems and components
--Remote operation, rendezvous, and docking
--Vision
--Sensors
--Artificial intelligence
--Simulation and tests

While this classification does not cover all of the problems and aspects connected with space robotics and undoubtedly will expand, it may, nonetheless, provide a basis for defining and directing future operations. Its goal is to make use of the considerable amount of know-how which has been gathered in Italy in the field of robotics and direct it toward space applications.

The contractors, and the relevant allocations, are indicated below:

Description	Contractor	Allocation
Study	Selenia	.085
Study	Fiar	.089

4. Mechanical Technologies

In this line, the NSP has funded several studies by academic institutions for the development of mathematical models of space radiators as well as models for large-size structures.

As far as industry is concerned, an agreement has been made with Contraves Italiana for the development of a mechanism capable of fulfilling definite functional requirements in the areas of deployment, articulation, and docking. This study is to be followed by the development of an engineering model.

A list of the contracting companies involved in this program is given below:

Phase	Description	Contractor	Allocation
A	Mechanical systems	Contraves	.180
BC	Research programs	Universities	.025
0	Hood cones	CISE	.118
0	Ring	AIT	.116
BC	Solar Cells	CISE	1.323

5. Electronic Technologies

This line of NSP-planned activities relates to the study and technological development of electronic devices and components to be employed for space programs.

Project-funding in the field of sensors included:

--"Star Sensor." This contract, which was awarded to CISE, Laben and Gavazzi, related to the development of a star sensor for the sighting system of the telescopes of the GAMMA 1 program.
--"Hood Cones." Study and development of a hood cone dimming measuring device; especially for the GAMMA 1 program. The contracting company is CISE.
--"IR Sensor." Galileo has developed, in this area, the elegant breadboard of an IR trim sensor for the control of low-orbit space platforms.

Because of the increasingly important role played by GaAS in component development and in the production of electrical energy in space, the NSP has started several programs in this area, including the following:

--"Monomic." The program to be implemented by Italtel, CISE and Selenia is aimed essentially at the acquisition of the technologies necessary for GaAS utilization in the development of devices for the direct reception of satellite telecast signals.
--"GaAS Solar Cell Panel." The program, in which CISE is involved as the prime contractor and Gavazzi as a subcontractor, concerns the design and development of a GaAS solar cell panel to be installed aboard the Eureca space platform of the ESA. This agreement was preceded by a feasibility study and by some preliminary experiments performed on the NASA shuttle.
--"Cell Production Pilot Line Study." In view of CISE's experience in the design and construction of GaAS solar cells and Fiar's reputation as a leading manufacturer of spacecraft electrical power systems, the

NSP has selected Fiar as a main contractor and CISE as a subcontractor for the study and development of an operation plan designed to assess and check, through the implementation of a pilot project, the production and coating processes of GaAS cells.

The contractual and financial data shown below concern the allocations made in the area of electronic technology alone:

Phase	Description	Contractor	Allocation
A	IR sensor	Galileo	.315
BC	Research program	CNR	.015
BC	Research program	Universities	.438
BCD	Star sensor	CISE	.562
BCD	Star sensor	CISE	2.700
BC	Pilot line	Fiar	1.741
0	GaA cells	CISE	.020
0	GaA panel	CISE	.070

6. Materials/Microgravity

In this sector, the NSP has financed studies and experiments to be performed on aerospace platforms, under microgravity conditions: SPACELAB, D1, TEXUS, EURECA.

In particular, the NSP has contributed financially to the development of the following devices:

--"NHV-Chamber Device" (CISE). This device has offered the opportunity to carry out several experiments in the science of materials aboard SPACELAB 1. The experiments concerned the study of a contact and adhesion tower.

--"FPM Module" (C.R. Fiat). Experiments in fluid physics aboard SPACELAB 1 and in the D1 mission have been performed with this device.

--"Poletti Device for Eureca/ESA." A 2-year research agreement with the University of Milan has been made for the design and the development of the equipment required for the "Surface Forces and Adhesion in Contacting Solids" experiment; this project is part of a broader materials research program including CISE's UHV-chamber device.

A preliminary experiment, carried out by Poletti himself, is to be performed aboard NASA's KC-135 aircraft.

Other experiments performed with the financial support of the NSP include:

--"Floatis Zones Study" on TEXUS (University of Naples)
--"Natural Convention" on SPACELAB 1 (University of Naples)
--"Marangoni Flows" on D1/SPACELAB (University of Naples)
--"Solidification of Metals" on SPACELAB 1 (University of Bologna)
--"Wettability of Ceramic Materials" on EURECA (ICFAM-CNR).

A list of the contracting companies and of the related allocations (in billions of lire) is shown below:

Phase	Description	Contractor	Allocation
BC	Research program	Universities	.614
BC	Research program	CNR	.031
0	Metal adhesion	CISE	.041
CD	UHV development	CISE	.938
E	UHV maintenance	CISE	.058
CD	Research program	CNR	.055
E	FPM maintenance	Fiat	.182
CD	FPM	Fiat	1.291
B	EURECA	Universities	1.275
B	Research program	Universities	.125

7. Budget Schedule

The funds for the aforementioned activities are to be allocated as follows:

Table 12

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) RICERCA TECN.		26.40	74.40	13.98	2.79	9.63						
	TLC	8.00					1.00	1.00	2.00	2.00	2.00	
	(5) PROPULSIONE	8.00					1.00	1.00	2.00	2.00	2.00	
	(6) ROBOTICA	8.00					1.00	1.00	2.00	2.00	2.00	
	(7) STRUTTURE/CONTROL.	8.00					1.00	1.00	2.00	2.00	2.00	
	(8) TECNOLOG.ELETTRON.	8.00					1.00	1.00	2.00	2.00	2.00	
	(9) MICROGRAVITA'	8.00					1.00	1.00	2.00	2.00	2.00	

Key:

1. Program
2. Phases
3. Totals
4. Technical research
5. Propulsion
6. Robotics
7. Structures/Control
8. Electronic technology
9. Microgravity

Studies and Developments for Future Activities

In order to ensure the overall consistency of the 5-year plan, the national space program must supplement the pending initiatives with studies and development plans capable of following the preceding ones without causing any perceivable gaps. This is why the chapter of the plan relating to Studies and Developments for Future Activities (which had been introduced into the previous revisions) has been retained and expanded. The ultimate goal is to create suitable opportunities for development on the industrial level in order to foster new projects which may prove critically important for future development. The overall financial situation may be summarized as follows:

Table 13

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) STUDI E SVIL.PER ATTIV.FUTURE		73.41	73.41	1.05	.36	12.00	12.00	12.00	12.00	12.00	12.00	

Key:

1. Programs
2. Phases
3. Totals
4. Studies and Development for Future Activity

Management Activities

Management of the Matera Station

According to the currently enforced management contract, under which Telespazio is to meet all the operational requirements of the Matera station, 4 billion lire are to be allocated during the 1985-87, 2-year period.

Under this same agreement, approximately 1.8 billion lire is to be invested for the development of suitable sites designed to accommodate mobile systems and to effect measurements with mobile SLR systems in Trieste and Cagliari in 1985-86 and in Greece in 1986-87 for the implementation of the relevant international programs.

Total investments for the operations that are to be carried out by the Matera station in coming years:

--1986	1.50 billion
--1987	2.50 billion
--1988	2.50 billion
--1989	2.50 billion
--1990	3.00 billion
--1991	3.00 billion

These figures relate to the management of the Matera station as well as to all the activities connected with the operation of the mobile laser.

Management of the Milo Base

The activity of the Milo Base is to be viewed against the background of a long-standing international agreement for the execution of annual trans-mediterranean flight programs, signed by INTA (Spain, CNES (France), and CNR (Italy) (see enclosure). In addition, throughout the world the scientific community is becoming more and more interested in this base, which has the necessary potential both for balloon launches at stratospheric altitudes for trans-mediterranean missions and for transcontinental flights.

At this point in time, therefore, the prime concern is to develop a suitable operations strategy to put the Milo base in the position to meet the demands of the scientific community. One of the essential steps involved in the process is the definition of a targeted cooperation program with Sicily's administrative bodies, which are expected to develop the relevant infrastructures. At the same time, the base needs reorganizing also at the industrial level for operations management; the reorganization plan is expected to be implemented along

the lines developed for the operation of the Matera laser-ranging station. The financial allocations required for the implementation of this program are estimated as follows:

--1986	4.09 billion
--1987	3.00 billion
--1988	3.00 billion
--1989	3.00 billion
--1990	3.00 billion
--1991	3.00 billion

Activities at Malindi

As is well known, suitable infrastructures for launches and for the acquisition of telemetry data have been developed at Malindi. So far the activities connected with the Malindi infrastructures have not been included in the NSP coordination plan. As these infrastructures are becoming increasingly important in the international context (especially in view of the prospective development of the telesurveillance programs for the developing countries), effective action must be taken in order to ensure proper development, management, and maintenance in the event that these activities are included in the overall management plan for national space activities. The estimated financial allocations are as follows (in billions of lire):

--1987	5.00 billion
--1988	5.00 billion
--1989	5.00 billion
--1990	5.00 billion
--1991	5.00 billion

Training of Specialists

This chapter relates to the financial requirements connected with the development of training schemes for specialists in the field of space technology.

The budget for this area of activity, which was introduced in the 1982-86 revised plan and subsequently confirmed by the 1984-88 plan, is as follows:

--1987	1.00 billion
--1988	2.00 billion
--1989	2.00 billion
--1990	2.00 billion
--1991	2.00 billion

Sirio and CRA

These items have been included only as a reminder and concern financial allocations made in past years on the basis of the plan submitted by CIPE.

Internal Management of the Plan

This section concerns the payroll expenses for all the people working within the plan, including freelance contributors and the members of the scientific committee and of the technical commissions, and to the overhead expenses involved in the implementation of the plan itself.

While the expenses listed below do not include the funds allocated under the finance act for the management of the Space Agency which is currently being established, they do emphasize the need to provide a suitable electronic processing system for the management of the plan in order to support the relevant technical and administrative services, and the need to establish new headquarters to keep in step with the continuous expansion in activities.

The relative financial allocations are shown below:

--1986	5.00 billion
--1987	5.00 billion
--1988	5.00 billion
--1989	5.00 billion
--1990	5.00 billion
--1991	5.00 billion

Advisory Services (Technical)

This section deals with the technical assistance activities which domestic and foreign companies or agencies are requested to perform in the specialized areas defined by the NSP.

In this connection, it should be pointed out that from 1987 the average annual expenditure (4 billion lire), which until now has been divided equally among domestic and foreign agencies, will be borne entirely by national organizations such as Telespazio, which offers comprehensive technical assistance services in a wide range of different areas.

The relevant funds are to be allocated as follows:

--1986	3.00 billion
--1987	4.00 billion
--1988	4.00 billion
--1989	4.00 billion
--1990	4.00 billion
--1991	4.00 billion

Advance Allocations

Following a CIPE request and the research minister's instructions, the funds for the completion of the D/L S. Marco program (5.4 billion) have been allocated in advance. An additional 19.35 billion lire has been allocated to the CNR for the indirect costs entailed by the management of the plan on the understanding that the minister will ensure that said funds are reallocated according to the original CIPE budget.

Budget Schedule

The figures relative to the allocations made for the activities connected with the management of the plan are shown below:

Table 12 [as published]

(1) PROGR.	(2) FASI	(3) TOTALI	TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(4) OPERAZIONI			76.05									
	TRAPANI	26.83		6.81	.93	4.09	3.00	3.00	3.00	3.00	3.00	
	MATERA	24.22		4.28	4.94	1.50	2.50	2.50	2.50	3.00	3.00	
	MALINDI	25.00					5.00	5.00	5.00	5.00	5.00	
(5) FORMAZIONE	(6) specialisti	9.00	9.00				1.00	2.00	2.00	2.00	2.00	
STRIO		5.64	5.64	5.30	.34							
CRA	S.MARCO D/L	20.00	20.00	20.00								
(7) GESTIONE	(8) STRUTTURA PSN/CNR	36.93	36.93	4.92	2.01	5.00	5.00	5.00	5.00	5.00	5.00	5.00
(9) SUPPORTO	(10) ASSISTENZA TECNICA	29.40	29.40	4.28	2.12	3.00	4.00	4.00	4.00	4.00	4.00	4.00
(11) ANTICIPAZIONI			24.75									
	(12) PREL. CNR	19.35			10.00	9.35						
	(13) anticipo cra	5.40				5.40						

Key:

1. Program
2. Phases
3. Totals
4. Operations
5. Training
6. Specialists
7. Management
8. NSP/CNR structure
9. Support
10. Technical assistance
11. Advance allocation
12. CNR allocation
13. CRA advance allocation

Extensions to Preceding Programs

Introduction

This section deals with developments concerning ongoing projects, resulting from feasibility studies and intended as natural followups to activities which already belong in a definite international context.

1. Subsequent Tethered Missions and Future Applications

The memorandum of understanding signed by NASA and the CNR for the Tethered system states that the two parties will also cooperate on Tether II and III missions.

According to the agreements made with NASA, the II mission is to hinge on a study of atmospheric phenomena, while the III mission centers on electrodynamic aspects. These two missions are expected to be carried out at intervals of approximately 2 years as compared with the Tether I mission.

The II and III missions call for several modifications to:

--The design of the scientific module;
--The thermal control subsystem (II mission);
--The development of an entirely new aerodynamic stabilization system (II mission);
--The wiring of the scientific payload.

The economic impact of the TSS II mission (inclusive of the Tether Refurbishment costs) has been estimated (as a percentage) on the basis of the corresponding activities carried out for the I mission (management, design monitoring, quality control, systems engineering, structure-thermal control-software subsystems, assembly-integration-testing) and by taking into account the activities concerning the newly developed equipment (wiring for the experiments and aerodynamic trim stabilization).

A similar procedure has been followed in order to assess the costs involved in the TSS III mission, the only difference being that in this case the refurbishment costs account for a smaller amount of the total outlay.

The Core Equipment Mission II (III TSS mission) includes the costs for:

--Overhauling the Core Equipment system used for the mission I;
--Defining, designing, and developing the additional portion of the new configuration;

--Carrying out verification and qualification checks of the added elements.

Another promising area for the development of the Tethered system concerns the implementation of the American space station. In this context, a number of demonstration missions are to be carried out, including the KITE (Kinematic Tether Experiments), which is expected to be developed by NASA in approximately 6 years (85-90); the first 3 missions are for study purposes while the last ones relate to the implementation of definite projects.

Negotiations are in progress for the definition of a NASA-NSP Joint Working Group, which is to plan those demonstration programs which are considered feasible on the basis of studies carried out by both agencies (NASA and NSP).

The underlying goal is, on the one hand, to evaluate the demonstrations proposed by either party and, on the other, to define a plan for those proposals that are considered feasible and interesting. This is expected to lead to the establishment of joint cooperation programs, which at a later stage will be defined in greater detail through a memorandum of understanding. The estimated cost for the successive Tethered missions and for their prospective applications is shown below (in billions of lire):

--1987	2.00 billion
--1988	6.00 billion
--1989	20.00 billion
--1990	30.00 billion
--1991	30.00 billion

2. SAR-X for SIR-D

The SAR program for participation in the SIR-D (a more detailed account of this program is given in the section, "Environmental and Terrestrial Observations"), though important for its scientific, technological and industrial implications, is bound to become strategically critical porovided adequate funds are allocated for the prospective development of the SIR-D mission. The latter is but a natural extension of the activities carried on in the field of synthetic angle radars, and is to play a major role in the utilization of the space station.

Consequently, the activities currently in progress are to be followed up with a SIR-D development program, according to which feasibility and preparatory studies are to be carried out as early as 1987.

The estimated financial investment for the development of the SIR-D program amounts to 45 billion lire, to be divided as follows:

--1988	5.00 billion
--1989	10.00 billion
--1990	20.00 billion
--1991	10.00 billion

3. Utilization Programs for SAR-X and ERS-1

Both the SAR-X and the ERS-1 telesurveillance programs--the former being implemented on a national basis, the latter being developed in the framework of the ESA--hopefully will result in the development of suitable hardware and software for the processing and production of sensor-acquired images to be employed in specific fields of application, for example, agriculture, oceanography, environmental control, and so on.

These aspects are expected to acquire considerable importance in view of the existing prospects for the promotion of business activities in the telesurveillance field.

The estimated financial allocations to be made for these programs are shown below (in billions of lire):

--1987	2.00 billion
--1988	2.00 billion
--1989	2.00 billion
--1990	2.00 billion
--1991	2.00 billion

4. Solid Propulsion Systems Based on IRIS

The work carried out by Italian industry in the development of the perigee stage of the IRIS program and in the development of new technologies, such as light thermal protection devices, a consumable igniter for solid propellant motors (ESA ASTP) and a light weight nozzle (NSP), has highlighted the possibility of improving the performance of perigee stage motors.

These breakthroughs are expected to result in the development of an advanced propulsion module, which will offer the opportunity to widen the field of application of the system itself. Moreover, extensive market surveys have pointed to the possibility of introducing a new motor, capable of combining the know-how gathered through the development of the IRIS project with the new technologies. The new

motor, which is to be operated by a smaller amount of propellant, should be employed as an apogee motor for loads weighing a few tons. Besides keeping solid propulsion motor technology in step with worldwide progress, the development of a motor of this kind would help fill a gap in present market requirements.

The financial aspects of the project may be summarized as follows:

--1988	6.50 billion lire
--1989	10.00 billion lire
--1990	10.00 billion lire
--1991	3.00 billion lire

New Programs

Introduction

A large number of new initiatives are currently in rapid progress, both on a worldwide and on a European level. An effort should be made to contribute to the implementation of these initiatives insofar as the funds allocated for the development of domestic activities allow, to ensure an adequate scientific and industrial return on the investments that our country has decided to make through the European Space Agency.

In addition, it is important to promote other initiatives based on the work performed in the first phase of the plan and to offer solid opportunities for the development of operative services in the more mature sectors, for example, telecommunications. As noted earlier, this level of activity relates to those programs for which immediate implementation is strategically important.

1. Italsat II Program

The Italsat program does not provide for the development of a second satellite. Thus, in the event of failure, the satellite would take at least 3 years to redevelop.

This is a considerably long timespan for a program which has been developed mostly for preoperative purposes, and may cause serious problems both in the implementation of the experimental schedule (experiments are to be carried out during the first 6 months of orbital life) and in the subsequent preoperative phase, in which case the Italsat system would not fit in with the schedule that has been drawn up for the development of the public telecommunications network.

This would also entail a considerable loss in terms of the investments made by the relevant telecommunications agencies (ISTP, SIP, Telespazio), which are to install and operate the communications stations.

In view of the above considerations and of the favorable attitude of the Higher Technical Council of the Ministry of the Postal and Telecommunication Services and of the contracting companies involved in this program, the NSP is to cover, in advance, part of the costs required by the development of the second satellite unit. This means that the NSP will provide the funds required for the construction of the second unit by using mainly long term consignment parts which are expected to cost 30 billion [lire] for the development of the flight unit.

By following this course of action, three options are available: the first implies the immediate repetition of the mission, in the event of an accident; the second concerns the possibility, in the event of the successful implementation of the mission, of transferring the second unit to the telecommunications agencies by being reimbursed; and the third implies the utilization of the second unit for a technological mission to be carried out in conjunction with the multibeam communications mission. In this case, a new technological payload would be fitted aboard the satellite along with the multibeam load, instead of the global and propagation payload. [carico utile globale e di propagazione]

Similarly, the base satellite may be used to carry some of the units developed in the framework of the plan's technological program rather than those which are currently installed aboard (which are not produced domestically).

It is quite clear, however, that the base satellite is to carry only those units that are technologically advanced and have reached a stage of development that is consistent with the standards established for the second Italsat flight unit. This does not apply, however, to the technological payload, which is not critically important in terms of the main mission (the Italsat multibeam mission) and which, therefore, is not expected to meet the stated development and reliability standards.

2. New Technologies for Telecommunications

Among the activities carried out in the field of communications payload technology, a particularly interesting role is being played by those involving:

--Intersatellite microwave and/or optical connections

--S-band and K-band data relays
--Telecommunications systems for mobile units and for low-cost, limited capability terminals.

The operations mentioned under point a) may relate to the development of millimetric wave transmitting/receiving and aiming systems (thus enhancing the development of VHF technologies, which started off with the development of 40/50Hz propagation packs) or center on optical frequency, which would boost the development of the relevant components and apparatus, for example, receivers, optical mode modulators, and lasers for space applications. As for the activities referred to in point b), areas of special interest include: increased S-band system capability for applications that are to be compatible with the TDRSS/NASA; development of K-band apparatus and antennas; and, finally, the application of regenerative techniques to the treatment of high-speed data flows on DRS satellites.

The most interesting among the areas of development mentioned under point c) are those which concern payloads for communications and radiolocation with mobile units and small terminals, including man/satellite communications; the development of equipment for sophisticated telecommunications systems, such as modems, numerical switching stages, processors, solid state senders, and so on.

The II spacecraft will also receive the 30 billion lire already referred to in the section dealing with Italsat. This amount is to be supplemented with the costs entailed by the launch (an estimated 114 billion lire), which are to be entered after 1991.

3. Development of New Space Subsystems

These activities aim at a gradual acquisition of the technologies required for the development of subsystems to be used for satellites engaged in scientific and applicational missions, as our domestic industry is not yet capable of meeting the technological requirements existing in this field. A special project is to focus on the study, design and development of a trim control system which may be used for the SAX scientific satellite or for future operational satellites of the Italsat type.

In this connection, it must be emphasized that Italy is lagging behind the other European countries and will have to fill this technological gap in the shortest possible time. An overview of Italy's industrial system shows that there are good prospects for the development of three-axis trim control subsystems. Indeed, both the necessary know-how in systems engineering and the technological potential for developing sensors, inertial units, electronic components, and control software are readily available.

4. Activities Related to the Development of Space Stations

4.1 Logistic Module

The U.S. space station includes a "Logistic System" designed to supply both the station itself and its users with all the logistical services that are required for extended periods in space.

The system consists essentially of four types of carriers, each designed to meet the logistical requirements of the station; these modules are to carry four different types of loads, that is:

--Pressurized loads
--Unpressurized loads
--Propellants
--Fluids

The pressurized load carrier module will also be used to provide the crew with a inhabitable facility for their activities. The steps involved in the logistical module plan include:

--Transfer to the orbiting station by means of an STS [expansion unknown]
--Supply/storage of provisions in orbit
--Return flight
--Replacement of/by similar modules carried into orbit by earlier flights (checkout to be performed prior to substitution).

The "Logistic System" also includes the so-called "Experiment Logistic Moduel" which, according to pending agreements, should be made available by Japan.

In this situation, an extremely important role is to be played by a bilateral cooperation agreement between Italy and the United States for the development of the logistical system; this involves logistical support for pressurized loads as well as other aspects, for example, robotics, refueling in flight, and so on, for which some initiatives have already been suggested by the NSP. In addition to this one, other types of agreements may be foreseen: Italy may request "payments in kind" for its contribution to the development of the space station system. Such nonmonetary rewards may include NASA contributions and services in connection with the utilization of the space station for national programs.

The overall investment figures for this program are shown below:

--1987	2.00
--1988	10.00
--1989	13.00
--1990	15.00
--1991	20.00

It is estimated that another 50 billion lire will be allocated after 1991--on the whole, a significant contribution to the development of the logistical system.

4.2 Synthetic Angle Radars for Polar Platforms

According to the programs that are being considered both in Europe (ESA) and in the United States (NASA and NOAA), polar orbit earth observations will be carried out by the polar component ("Polar Platform") of the space stations (the American "Space Station" and the European "Columbus").

Two polar platforms (ESA and NOAA/NASA) and one research platform (NASA) are expected to become operational as of 1994. The polar platform is the natural outcome of the technological activities carried on in the field of sensor development.

In accordance with these international development plans, the NSP has already established that the last phase of the SAR-X program will focus on the development of a highcapability model to be installed on one or more of the polar platforms. The details of this program depend, naturally, on the results of the present activities of the SIR-C and of the future ones of the SIR-D.

The funds to be allocated over the 5-year period are indicated below:

--1988	2.00
--1989	10.00
--1990	10.00
--1991	20.00

An estimated 50 billion lire, for the years following 1991, are to be added to the above figures.

5. Columbus Utilization Program

The European Columbus program, in which Italy is participating with a significant financial and industrial contribution, will become operational by the mid-1990s.

In the course of 1986, the plan shall program, develop, and implement specific operations and initiatives in order to provide for the scientific utilization of the Columbus on a national level, the extent of such utilization being proportional to the investments made by Italy for the development and implementation of the program in cooperation with other ESA members. Once it is fully operative, the Columbus system will consist of an inhabited pressurized module (capable of operating in conjunction with the space stations developed by NASA as well as an independent "free flyer") and of a number of polar or coorbiting platforms; the program also includes the development and implementation of multiuser facilities for the performance of experiments.

The scientific and technological activities that will be performed through the Columbus concern microgravity (science of materials, fluid dynamics), life sciences (biology, medicine), and earth sciences--disciplines in which Europe has acquired a considerable amount of knowledge thanks to the missions carried out by the Spacelab.

Following the instructions given by the Ministry of Scientific Research, an Italian team has been sent to Germany to cooperate on the Columbus program. Both the Italian and the German teams are currently working on a plan of the relevant activities, including the aspects connected with utilization.

The preparatory activities relating to the utilization of the Columbus involve three different levels:

--Activities based on promotion, information, and selection in order to identify the experimental areas that are of major interest to the national agencies or industries which have the potential for engaging in extensive research programs;
--Preliminary surveys and technical-scientific feasibility studies; participation of Italian researchers in preparatory microgravity tests by employing the facilities and equipment made available by the ESA and NASA, for example, suborbital rockets (European Texus program) and parabolic flights (KC-135 NASA program);
--Start-up and financial support of national research programs to be subsequently selected for inclusion in the Columbus mission.

Yet another level of intervention for the implementation of the plan relates to "ground infrastructures." Indeed, the draft of the program recognizes the need to support and rationalize the activities of the European users (interface and simulation tests, Columbus databank, planning of experiments) by establishing national "support centers" connected to each other on a European level, and interacting with the Columbus Control Center during the mission.

The overall investment plan may be summarized as follows:

--1987	1.00
--1988	2.00
--1989	5.00
--1990	10.00
--1991	10.00

6. Refueling in Orbit With Liquid Propellants
Maintenance Operations in Orbit

The new programs for space utilization (Columbus, space stations, etc.) emphasize the importance of extending satellite and platform life through the adoption of suitable propellant refueling systems.

Feasibility studies have been carried out in this connection, mainly to identify the many and complex problems involved in this operation. The development of a suitable apparatus (which may be applied as a fixture on vehicles such as OMVs, space vehicles, Hermes, etc.) would be an extremely challenging high-tech program and would offer several domestic industries the opportunity to keep in step with the ultimate requirements in the field of space operations. It should be noted that the present situation in European space station development does not include extravehicular activities; however, the development of Hermes coupled with the need to perform maintenance operations in space and to achieve an ever greater degree of autonomy in the field of space technology call for the development of a system for extravehicular human maneuvers.

As these systems are thought to be implementable only on a European level, a suggestion has been made to carry the project into phase B in order to offer the domestic industry the possibility of acting as a prime contractor in a prospective ESA program.

The overall investments are estimated at roughly 15 billion lire, as follows:

--1987	2.50
--1988	10.00
--1989	2.50

7. Estimated Investment Plan

The following table includes the figures concerning the total investments made for these programs which are considered merely follow-ups to existing programs as well as for the new programs designed to meet the current strategic requirements in the most important areas of space activity.

Table 13 [as published]

(1) PROGR.	(2) FASI	(3) TOTALI	(4) TOT.PROG	< 1985	1985	1986	1987	1988	1989	1990	1991	>1991
(5) CONTINUAZ.			172.50									
	(6) TETHER CONT.+DEMO	88.00					2.00	6.00	20.00	30.00	30.00	60.00
	SIR-D	45.00						5.00	10.00	20.00	10.00	
	(7) UTILIZ.SAR-X+ERS-1	10.00					2.00	2.00	2.00	2.00	2.00	
	(8) IRIS II+MOTORE	29.50						6.50	10.00	10.00	3.00	
ITALSAT II			80.00									
	(9) SEC.UNITA' DI VOLO	45.00					2.00	13.00	20.00	10.00		
	(10) LANCIO	0.00										114.00
	(11) NUOVI PAYLOAD TLC	35.00					1.00	4.00	10.00	10.00	10.00	
(12) SVILUPPO	(13) NUOVI SOTTOS. S/C	35.00	35.00				1.00	4.00	10.00	10.00	10.00	
SPACE STATION			144.50									
	LOGISTIC SYSTEM	60.00		–			2.00	10.00	13.00	15.00	20.00	50.00
	POLAR PLATF.SAR-X	42.00						2.00	10.00	10.00	20.00	50.00
	UTILIZZ.COLUMBUS	28.00					1.00	2.00	5.00	10.00	10.00	
	PREP.REFUEL+AMMU	14.50					2.00	10.00	2.50			

Key:

1. Program
2. Phases
3. Totals
4. Total Program
5. Follow-up
6. Follow-up /Tether + DEMO
7. Utiliz. SAR-X + ERS-1
8. IRIS II + MOTOR
9. Second Flight Unit
10. Launch
11. New TLC Payloads
12. Development
13. New Subsystems S/C

Distribution of contracts assigned according to sector

(1) FINANZIAMENTI PSN

(2) PROGRAMMA	(3) PROGETTO	(4) DESCRIZIONE	(5) PRIME/CONTR.	(6) SUB/CONTR.	(7) COSTO PARZ.	(8) IMPEGNO	(9) ANNO
(10) ANTICIPAZ.	CNR	(11) SPESE GENERALI PSN	(12) CNR-SEDE	CNR-SEDE	9350	9,350	86
		SPESE GENERALI PSN	CNR-SEDE	CNR-SEDE	10000	10,000	85
	S.MARCO	(13) OPERAZ.	UNIV.ROMA	UNIV.ROMA	5400	5,400	86
					Total:	24,750	
(14) GESTIONE PSN	(15) CONSULENZE	CONSULENZE	GCE	GCE	430	567	86
		CONSULENZE	COMSAT	COMSAT	989	989	85
		CONSULENZE	CNUCE	CNUCE	105	105	85
		CONSULENZE	ESA	ESA	640	640	84
		CONSULENZE	GCE	GCE	210	248	85
		CONSULENZE	CISE	CISE	105	124	83
		CONSULENZE	ESA	ESA	632	632	83
		CONSULENZE	COMSAT	COMSAT	322	322	81
		CONSULENZE	GCE	GCE	87	103	83
		CONSULENZE	COMSAT	COMSAT	410	410	82
		CONSULENZE	ESA	ESA	535	535	82
		CONSULENZE	ESA	ESA	212	212	81
		CONSULENZE	ESA	ESA	2333	2,333	85
		CONSULENZE	COMSAT	COMSAT	1241	1,241	83
		CONSULENZE	CNUCE	CNUCE	45	45	84
		CONSULENZE	TELESPAZIO	TELESPAZIO	1140	1,345	86
	PSN	GESTIONE	CNR/PSN	CNR/PSN	693	693	81
		GESTIONE	CNR/PSN	CNR/PSN	358	358	80
		GESTIONE	CNR/PSN	CNR/PSN	1367	1,367	84
		GESTIONE	CNR/PSN	CNR/PSN	1204	1,204	83
		GESTIONE	CNR/PSN	CNR/PSN	1295	1,295	82
		GESTIONE	CNR/PSN	CNR/PSN	2022	2,022	85
		GESTIONE	CNR/PSN	CNR/PSN	2550	2,550	86
					Total:	19,340	
LAGEOS	LAGEOS	(16) REALIZZAZ.	AIT	AIT	14932	24,142	85
		LAND	NASA	NASA	555	556	85
		REALIZZAZ.	AIT	ZYGO	1158		85
		REALIZZAZ.	AIT	MICROTECNICA	1236		85
		PROGETTO	AIT	AIT	597	692	83
		REALIZZAZ.	AIT	BPD/SEP	1426		85
		REALIZZAZ.	AIT	MDAC	2800		85
		REALIZZAZ.	AIT	YARDNEY	359		85
		REALIZZAZ.	AIT	LABEN	2231		85
					Total:	25,490	
OPERAZIONI	MATERA	OPERAZ.	TELESPAZIO	TELESPAZIO	3897	4,598	85
		CONSUL.	SAO	SAO	35	35	84
		(17) INSTALLAZ.	TELESPAZIO	TELESPAZIO	818	965	83
		INSTALLAZ.	SAO	SAO	70	70	83
		OPERAZ.	TELESPAZIO	TELESPAZIO	2278	2,601	83
		OPERAZ.	DIGITAL	DIGITAL	220	259	84
	S.MARCO	OPERAZ.	UNIV.ROMA	UNIV.ROMA	17000	17,000	82
		OPERAZ.	UNIV.ROMA	UNIV.ROMA	3000	3,000	79
	TRAPANI	(18) STUDI SIST.	GAVAZZI	GAVAZZI	59	70	83
		STUDI SIST.	LABEN	LABEN	59	70	83
		(19) CAMPAGNA	CNR/PSN	CNR/PSN	1244	1,244	80

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANNO
		CAMPAGNA	CNR/PSN	CNR/PSN	1628	1,628	79
		CAMPAGNA	CNR/PSN	CNR/PSN	1165	1,168	81
		CAMPAGNA.	CNR/PSN	CNR/PSN	820	820	83
		CAMPAGNA	CNR/PSN	CNR/PSN	1047	1,047	82
		CAMPAGNA	CNR/PSN	CNR/PSN	260	260,	84
		CAMPAGNA	CNR/PSN	CNR	454	454	84
	(20)	ASSISTENZA	LABEN	LABEN	43	50	82
		CAMPAGNA	CNR/PSN	CNR/PSN	490	490	85
		CAMPAGNA	CNR/PSN	CNR	442	442	85
	(21)	PALLONE	ZODIAC	ZODIAC	80	80	86
		CAMPAGNA	CNR/PSN	CNR/PSN	530	530	86
					Total:	36,881	
(22) S. AMBIENT.	SECDESIA	LASER MOB.	CISE	CISE	1880	2,218	86
		VLBI	SELENIA	SELENIA	6625	8,053	86
		VLBI	CNR	CNR	30	30	83
		VLBI	UNIVERS.	UNIVERS.	182	182	83
		VLBI	TELESPAZIO	TELESPAZIO	150	173	81
		VLBI	SELENIA	SELENIA	937	1,106	84
		LASER MOB.	CISE	CISE	147	174	82
		VLBI	UNIVERS.	UNIVERS.	25	25	82
	TLR	SAR-X	SELENIA	SELENIA	1596	1,883	85
		PR. PILOTA	TELESPAZIO	TELESPAZIO	729	1.567	84
		PR. PILOTA	TELESPAZIO	CSATA	600		84
		EMMA-VDS	TELESPAZIO	TELESPAZIO	849	1,002	84
		EMMA-VDS	VDS	VDS	842	994	84
		SAR-X	SELENIA	SELENIA	592	699	84
		SAR-X	CISE	CISE	40	401	80
		SAR-X	CISE	CONTRAVES	130		80
		SAR-X	CISE	SELENIA	142		80
		SAR-X	CISE	SMA	40		80
		SAR-X	AQUATER	AQUATER	10	15	81
	(23)	PR. PILOTA	TELESPAZIO	TELESPAZIO	255	294	81
		EMMA-VDS	CNR	CNR	20	20	85
		PR. PILOTA	CSATA	CSATA	60	70	81
		PR. PILOTA	TELESPAZIO	TELESPAZIO	152	312	81
		PR. PILOTA	TELESPAZIO	CSATA	119		81
		PR. PILOTA	CSATA	CSATA	165	190	80
		PR. PILOTA	TELESPAZIO	TELESPAZIO	492	741	82
		PR. PILOTA	TELESPAZIO	CSATA	153		82
		PR. PILOTA	BELFOTOP	BELFOTOP	107	107	81
		PR. PILOTA	CNR	CNR	480	480	85
		PR. PILOTA	UNIVERS.	UNIVERS.	320	320	85
		EMMA-VDS	TELESPAZIO	TELESPAZIO	50	58	82
		EMMA-VDS	TELESPAZIO	ELSAG	2286		85
		EMMA-VDS	TELESPAZIO	TELESPAZIO	2594	5,717	85
		EMMA-VDS	UNIVERS.	UNIVERS.	10	10	85
		PR. PILOTA	UNIVERS.	UNIVERS.	315	315	84
		PR. PILOTA	UNIVERS.	UNIVERS.	303	303	83
		PR. PILOTA	UNIVERS.	UNIVERS.	463	463	82
		PR. PILOTA	UNIVERS.	UNIVERS.	65	65	81
		PR. PILOTA	UNIVERS.	UNIVERS.	527	527	80
		PR. PILOTA	UNIVERS.	UNIVERS.	470	470	79
		PR. PILOTA	CNR	CNR	71	71	79

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANNO
		PR. PILOTA	CNR	CNR	406	406	80
		PR. PILOTA	CNR	CNR	234	234	81
		PR. PILOTA	CNR	CNR	403	403	82
		PR. PILOTA	CNR	CNR	450	450	83
		PR. PILOTA	CNR	CNR	480	480	84
					Total:	31,028	
(24) PROPULS.	EGSE	REALIZZAZ.	LABEN	LABEN	4512	5,324	84
	IRIS	SVIL.ASE	AIT	MICROTECNICA	4393		84
		SVIL.ISS	BPD	BPD	14987	22,748	84
		SVIL.ISS	BPD	AIT	2219		84
		SVIL.ISS	BPD	FIAR	599		84
		SVIL.ISS	BPD	LABEN	4943		84
	(25)	PRENOTAZIONE	NASA	NASA	116	116	79
		TELEM.	BPD	BPD	131	131	83
	(26)	PROGETTO PREL.	BPD	BPD	1232	3,841	80
		PROGETTO PREL.	BPD	AIT	1015		80
		PROGETTO PREL.	BPD	SELENIA	172		80
		PROGETTO PREL.	BPD	CNS	475		80
		PROGETTO PREL.	BPD	LABEN	465		80
		PROGETTO	AIT	AIT	3823	9,223	82
		PROGETTO	AIT	BPD	3057		82
		PROGETTO	AIT	FIAR	133		82
		PROGETTO	AIT	LABEN	814		82
		PROGETTO	AIT	MICROTECNICA	293		82
		SVIL.ASE	AIT	AIT	16892	27,769	84
		SVIL.ASE	AIT	FIAR	1636		84
		SVIL.ASE	AIT	LABEN	4848		84
		REAL.MOD.ISS	BPD	FIAR	2174		86'
		REAL.MOD.ISS	BPD	LABEN	3479		86'
		REAL.MOD.ISS	BPD	AIT	[illegible]		86'
		REAL.MOD.ISS	BPD	BPD	27554	22,670	86'
		REAL.MOD.ASE	AIT	LABEN	5432		86'
		REAL.MOD.ASE	AIT	FIAR	1606		86'
		REAL.MOD.ASE	AIT	MICROTECNICA	3876		86'
		REAL.MOD.ASE	AIT	AIT	47621	37,777	86'
					Total:	129,599	
(27) RIC. TECNOL.	MICROGR.	PROGRAMMI	UNIVERS.	UNIVERS.	130	130	83
		PROGRAMMI	CNR	CNR	31	31	84
		PROGRAMMI	UNIVERS.	UNIVERS.	294	294	84
		PROGRAMMI	UNIVERS.	UNIVERS.	150	150	82
		REALIZZAZ.UHV	CISE	CISE	823	938	80
		MANUTENZ.UHV	CISE	CISE	50	58	81
		ADES.METALLI	CISE	CISE	35	41	84
		PROGRAMMI	UNIVERS.	UNIVERS.	40	40	85
		PROGRAMMI	CNR	CNR	55	55	85
		MANUTENZ.FPM	FIAT	FIAT	157	182	82
		FPM	FIAT	FIAT	1132	1,291	80
		EURECA	UNIVERS.	RIAL	85		85
		EURECA	UNIVERS.	UNIVERS.	325	1,275	85
		EURECA	UNIVERS.	CENTROTECNICA	390		85
		EURECA	UNIVERS.	CONTROL SYSTEM	280		85

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANNO
		PROGRAMMI	UNIVERS.	UNIVERS.	125	125	80
	PROPULS.	ENDOREATT.	FIAT	FIAT	135	159	84
		FATT.PROP.	BPD	BPD	49	58	83
	(28) ROBOTICA	PROGETTO	SELENIA	SELENIA	72	85	85
		PROGETTO	FIAR	FIAR	76	89	84
	(29) TECN. ELETTR.	PROGRAMMI	UNIVERS.	UNIVERS.	30	30	85
		SENSORE IR	GALILEO	GALILEO	267	315	85
		PROGRAMMI	CNR	CNR	15	15	83
		(30) SENS. STELL.	CISE	CISE	130	562	84
		SENS. STELL.	CISE	GAVAZZI	113		84
		SENS. STELL.	CISE	LABEN	233		84
		SENS. STELL.	CISE	CISE	990	2,700	81
		SENS. STELL.	CISE	GAVAZZI	340		81
		SENS. STELL.	CISE	LABEN	1070		81
		(31) LINEA PILOTA	FIAR	CISE	780		85
		LINEA PILOTA	FIAR	FIAR	695	1,741	85
		(32) CELLE GAAS	CISE	CISE	17	20	83
		(33) PANN.GAAS	CISE	CISE	59	70	83
		PROGRAMMI	UNIVERS.	UNIVERS.	14	14	84
		PROGRAMMI	UNIVERS.	UNIVERS.	27	27	83
		PROGRAMMI	UNIVERS.	UNIVERS.	297	297	82
	(34) TECN. MECC.	PROGRAMMI	UNIVERS.	UNIVERS.	95	95	83
		SISTEMI MECC.	CONTRAVES	CONTRAVES	153	180	85
		(35) CONI PARAL.	CISE	CISE	100	118	84
		(36) ANELLO.	AIT	AIT	101	116	80
		(37) CELLE SOLARI	CISE	LABEN	441		85
		CELLE SOLARI	CISE	CISE	700	1,323	85
	TLC	PROGRAMMI	UNIVERS.	UNIVERS.	216	216	83
		PROGRAMMI	CNR	CNR	36	36	85
		(38) COLLEG. ITALSAT-ACTS	TELESPAZIO	TELESPAZIO	90	106	86
		PROGR. TEL.	FUB	FUB	85	98	81
		MONOMIC	ITALTEL	ITALTEL	1517	5.000	81
		MONOMIC	ITALTEL	CISE	1971		81
		MONOMIC	ITALTEL	SELENIA	1008		81
		MONOPULSE	TELESPAZIO	TELESPAZIO	27	31	81
		PROP.UNIF.	TELESPAZIO	TELESPAZIO	60	70	81
		CLUSTER	CNS	CNS	172	198	81
		CONSULENZE	CNUCE	CNUCE	82	82	83
		PROGRAMMI	UNIVERS.	UNIVERS.	181	181	81
		PROGRAMMI	CNR	CNR	166	166	82
		PROGRAMMI	CNR	CNR	261	261	83
		PROGRAMMI	CNR	CNR	98	98	84
		PROGRAMMI	CNR	CNR	75	75	86
					Total:	19,242	
SAX	GROUND A B	(39) SEGMENTO TERRA	TELESPAZIO	TELESPAZIO	1932	2,230	86
	SAX	(40) SISTEMA	AIT	AIT	568	670	83
		PROGETTO	AIT	FOKKER	268		86
		PROGETTO	AIT	SELENIA	302		86
		PROGETTO	AIT	TELESPAZIO	138		86
		PROGETTO	AIT	BPD	673		86
		PROGETTO	AIT	FIAR	420		86
		PROGETTO	AIT	LABEN	618		86
		PROGETTO	AIT	AIT	7703	11,944	86

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANNO
					Total:	14,844	
SPACE SCIENCE	PAYLOAD SAX	(41) ESPERIM.	CNR	CNR	13	13	86
		SISTEMA	CNR	CNR	66	66	83
		SISTEMA	UNIVERS.	UNIVERS.	523	523	84
		SISTEMA	CNR	CNR	79	79	84
		SISTEMA	CNR	CNR	1640	1,640	85
		SISTEMA	UNIVERS.	UNIVERS.	196	196	85
		(42) STUDIO	LABEN	LABEN	288	340	83
		PROG. P/L	AIT	LABEN	2875	3,392	86
		SISTEMA	UNIVERS.	UNIVERS.	9	9	83
	PAYLOAD TETHER	ESPERIM.	CNR	CNR	423	423	85
		ESPERIM.	UNIVERS.	UNIVERS.	170	170	85
		ESPERIM.	GAVAZZI	GAVAZZI	339	399	85
		PRENOT. TEMAG	NASA	NASA	206	206	85
		ESPERIM.	GAVAZZI	GAVAZZI	253	296	85
		ESPERIM.	GAVAZZI	GAVAZZI	477	563	85
		ESPERIM.	UNIVERS.	UNIVERS.	8	8	83
		ESPERIM.	UNIVERS.	UNIVERS.	56	56	84
		ESPERIM.	CNR	CNR	90	90	83
		ESPERIM.	CNR	CNR	92	92	84
(43)	SC. ASTRON.	ESPERIM.	UNIVERS.	UNIVERS.	55	55	86
		HIPPARCOS	CSS	CSS	745	880	85
		GAMTEL	LABEN	LABEN	315	372	85
		GIOTTO	LABEN	LABEN	59	69	84
		GIOTTO	GAVAZZI	GAVAZZI	99	117	84
		GIOTTO	GALILEO	GALILEO	20	24	84
		GIOTTO	GALILEO	GALILEO	7	8	84
		HIPPARCOS	CSATA	CSATA	119	141	84
		GAMTEL	LABEN	LABEN	140	165	84
		ESPERIM.	CNR	CNR	441	441	85
		ESPERIM.	UNIVERS.	UNIVERS.	636	636	85
		ESPERIM. PALL.	CNR	CNR	1385	1,385	85
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	212	212	85
		HIPPARCOS	CSS	CSS .	181	216	82
		HIPPARCOS	UNIVERS.	UNIVERS.	137	137	84
		HIPPARCOS	CSS	CSS	254	300	83
		HIPPARCOS.	CSATA	CSATA	83	98	83
		GIOTTO	LABEN	LABEN	450	518	81
		GIOTTO	UNIVERS.	UNIVERS.	100	100	85
		GIOTTO	CNR	CNR	102	102	85
		GIOTTO	GALILEO	GALILEO	607	720	82
		GIOTTO	GAVAZZI	GAVAZZI	282	316	82
		GIOTTO	GALILEO	GALILEO	198	228	81
		GAMTEL	LABEN	LABEN	451	533	83
		STAR SENS.	CNR	CNR	80	80	84
		HIPPARCOS	CSATA	CSATA	404	477	85
		GIOTTO	CNR	CNR	140	140	83
		GIOTTO	CNR	CNR	89	89	84
		HIPPARCOS	UNIVERS.	UNIVERS.	20	20	80
		HIPPARCOS	UNIVERS.	UNIVERS.	32	32	81
		HIPPARCOS	UNIVERS.	UNIVERS.	130	130	82
		HIPPARCOS	UNIVERS.	UNIVERS.	109	109	83
		ESPERIM.	UNIVERS.	UNIVERS.	870	870	83

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANNO
		ESPERIM.	UNIVERS.	UNIVERS.	621	621	84
		ESPERIM.	CNR	CNR	796	796	79
		ESPERIM.	CNR	CNR	742	742	80
		ESPERIM.	CNR	CNR	717	717	81
		ESPERIM.	CNR	CNR	450	450	82
		ESPERIM.	CNR	CNR	582	582	83
		ESPERIM.	CNR	CNR	462	482	84
		STAR SENS.	CNR	CNR	15	15	81
		STAR SENS.	CNR	CNR	107	107	82
		STAR SENS.	CNR.	CNR	110	110	83
		GIOTTO	UNIVERS.	UNIVERS.	105	105	81
		GIOTTO	UNIVERS.	UNIVERS.	61	61	82
		GIOTTO	UNIVERS.	UNIVERS.	60	60	83
		GIOTTO	UNIVERS.	UNIVERS.	112	112	84
		GIOTTO	CNR	CNR	17	17	81
		GIOTTO	CNR	CNR	140	140	82
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	133	133	84
		ESPERIM. PALL.	CNR	CNR	184	184	79
		ESPERIM. PALL.	CNR	CNR	401	401	80
		ESPERIM. PALL.	CNR	CNR	1578	1,578	81
		ESPERIM. PALL.	CNR	CNR	1382	1,382	82
		ESPERIM. PALL.	CNR	CNR	1840	1,840	83
		ESPERIM. PALL.	CNR	CNR	1648	1,648	84
		ESPERIM.	UNIVERS.	UNIVERS.	256	256	79
		ESPERIM.	UNIVERS.	UNIVERS.	840	840	80
		ESPERIM.	UNIVERS.	UNIVERS.	766	766	81
		ESPERIM.	UNIVERS.	UNIVERS.	801	801	82
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	29	29	79
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	159	159	80
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	118	118	81
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	202	202	82
		ESPERIM. PALL.	UNIVERS.	UNIVERS.	309	309	83
(44)	SC. TERRA	MOTO DEL POLO	TELESPAZIO	TELESPAZIO	93	110	86
		MOTO DEL POLO	TELESPAZIO	TELESPAZIO	87	100	~~83~~
		RIC. GEOD.	UNIVERS.	UNIVERS.	285	285	85
		RIC. GEOD.	CNR	CNR	28	28	85
		RIC. GEOD.	UNIVERS.	UNIVERS.	190	190	84
(45)	SC. VITA	ESPERIM.	UNIVERS.	UNIVERS.	439	439	85
		ESPERIM.	UNIVERS.	UNIVERS.	141	141	79
		ESPERIM.	UNIVERS.	UNIVERS.	108	108	80
		ESPERIM.	UNIVERS.	UNIVERS.	54	54	81
		ESPERIM.	UNIVERS.	UNIVERS.	53	53	82
		ESPERIM.	UNIVERS.	UNIVERS.	139	139	83
		ESPERIM.	UNIVERS.	UNIVERS.	343	343	84
					Total:	36,036	
(46) STUDI ATT. FUT.	COLUMBUS	SISTEMI	AIT	AIT	147	174	83
	EESE	PROGETTO	LABEN	LABEN	118	137	83
	ENDOREATTORE	PROGETTO	FIAT	FIAT	1142	1,347	86
	PROPULSIONE	PROGETTO	BPD	BPD	1675	2,213	86
	STUDI	RADIOM. MICR.	SELENIA	SELENIA	143	169	85
		SIST.ALL.	FIAR	FIAR	233	275	84
		STUDI SL	AIT	AIT	108	124	81
		ATT. FUT.	AIT	AIT	57	65	80

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANN
		TETHER	AIT	AIT	57	65	80
		FATT. SAX	AIT	AIT	150	173	81
		STAZ. SPAZ.	UNIVERS.	UNIVERS.	60	60	86
		STAZ. SPAZ.	UNIVERS.	UNIVERS.	39	39	81
	TETHER AV.	STUDI	AIT	AIT	2712	3,193	85
	TURBO POMPA	PROGETTO	FIAT	FIAT	358	422	86
					Total:	8,458	
TELECOM.	ITALSAT	REALIZZAZ.	SELENIA	SELENIA	41721	70,101	85
		ATTO AGG.	SELENIA	SELENIA	418	418	85
		(47) GEST.ORB.	TELESPAZIO	TELESPAZIO	927	1,094	84
		SISTEMA	TELESPAZIO	CSELT	431		82
		SISTEMA	TELESPAZIO	COMSAT	461		82
		PROGETTO	CNS	CNS	7620	18,326	82
		PROGETTO	CNS	AIT	1771		82
		PROGETTO	CNS	BPD	1057		82
		PROGETTO	CNS	FIAR	197		82
		PROGETTO	CNS	LABEN	675		82
		PROGETTO	CNS	SELENIA	4746		82
		SVILUPPO	SELENIA	SELENIA	17517	36.457	84
		CONFIGUR.	TELESPAZIO	TELESPAZIO	847	2,851	80
		(48) CONFIGUR.	TELESPAZIO	CNS	1098		80
		CONFIGUR.	TELESPAZIO	SELENIA	552		80
		(49) SERV.SPEC.	TELESPAZIO	TELESPAZIO	77	86	81
		PRENOT. LAN.	NASA	NASA	174	174	82
		CONSULENZE	TELESPAZIO	TELESPAZIO	92	106	81
		ATTO AGG.	CNS	CNS	115	135	83
		SISTEMA	TELESPAZIO	TELESPAZIO	3209	6,402	82
		SISTEMA	TELESPAZIO	SELENIA	1600		82
		SISTEMA	TELESPAZIO	CSTS	15		82
		REALIZZAZ.	SELENIA	INTA	40		85
		REALIZZAZ.	SELENIA	ENIAS	440		85
		REALIZZAZ.	SELENIA	FORD	280		85
		REALIZZAZ.	SELENIA	MITSUBISHI	340		85
		REALIZZAZ.	SELENIA	COMDEV	900		85
		REALIZZAZ.	SELENIA	EMS	300		85
		REALIZZAZ.	SELENIA	AEG	870		85
		REALIZZAZ.	SELENIA	TRANSCO	310		85
		REALIZZAZ.	SELENIA	BAE	1200		85
		REALIZZAZ.	SELENIA	MATRA/GALILEO	4500		85
		REALIZZAZ.	SELENIA	GTE	1680		85
		REALIZZAZ.	SELENIA	FIAR	3500		85
		REALIZZAZ.	SELENIA	LABEN	1960		85
		REALIZZAZ.	SELENIA	BPD	7000		85
		REALIZZAZ.	SELENIA	AIT	5040		85
		REALIZZAZ.	SELENIA	LABEN	7706		86
		REALIZZAZ.	SELENIA	SELENIA	129616	96.658	86
		SVILUPPO	SELENIA	LABEN	1739		84
		SVILUPPO	SELENIA	FIAR	243		84
		SVILUPPO	SELENIA	BPD	4663		84
		SVILUPPO	SELENIA	MATRA	2354		84
		SVILUPPO	SELENIA	GALILEO	636		84
		SVILUPPO	SELENIA	AIT	9305		84
		(50) LANCIO STS	SELENIA	NASA	6967		86

FINANZIAMENTI PSN

PROGRAMMA	PROGETTO	DESCRIZIONE	PRIME/CONTR.	SUB/CONTR.	COSTO PARZ.	IMPEGNO	ANN
		REALIZZAZ.	SELENIA	MITSUBISHI	1659		86'
		REALIZZAZ.	SELENIA	AEG	4999		86'
		REALIZZAZ.	SELENIA	TRANSCO	1658		86'
		REALIZZAZ.	SELENIA	COMDEV	5193		86'
		REALIZZAZ.	SELENIA	EMS	1460		86'
		REALIZZAZ.	SELENIA	GTE-IFA	12832		86'
		REALIZZAZ.	SELENIA	INTA	436		86'
		REALIZZAZ.	SELENIA	BAE	11585		86'
		REALIZZAZ.	SELENIA	FORD	3007		86'
		REALIZZAZ.	SELENIA	AEROSPATIALE	6748		86'
		REALIZZAZ.	SELENIA	FIAR	17676		86'
		REALIZZAZ.	SELENIA	MATRA	21185		86'
		REALIZZAZ.	SELENIA	BPD	18503		86'
		REALIZZAZ.	SELENIA	GALILEO	4032		86'
		REALIZZAZ.	SELENIA	AIT	7260		86'
	OLYMPUS	STUDIO	TELESPAZIO	TELESPAZIO-	105	124	86
	SIRIO	GESTIONE	TELESPAZIO	TELESPAZIO	2786	2,786	81
		ESPERIM.	CNR	CNR	156	156	79
		ESPERIM.	CNR	CNR	131	131	80
		VERTENZA	SELENIA	SELENIA	340	340	85
		GESTIONE	TELESPAZIO	TELESPAZIO	2000	2,000	82
		GESTIONE	FUB	FUB	59	59	86
		GESTIONE	TELESPAZIO	TELESPAZIO	49	58	86
		ESPERIM.	UNIVERS.	UNIVERS.	231	231	80
					Total:	238,693	
TETHER	TETHER	REALIZZAZ.	AIT	AIT	38156	54,000	85
		CORE EQUIP.	AIT	AIT	592	699	85
		PROGETTO	AIT	AIT	3640	4,120	81
		BRIDG.PHASE	AIT	AIT	4950	5,925	84
		BRIDG.PHASE	AIT	BPD	359		84
		BRIDG.PHASE	AIT	FIAR	140		84
		BRIDG.PHASE	AIT	LABEN	338		84
		BRIDG.PHASE	AIT	SELENIA	82		84
		REALIZZAZ.	AIT	LABEN	6010		85
		REALIZZAZ.	AIT	BPD	5195		85
		REALIZZAZ.	AIT	FIAR	2106		85
		REALIZZAZ.	AIT	SELENIA	2533		85
					Total:	64,744	
					Total:	649,105	

Contracts assigned according to subject (companies, research centers).

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
AEG	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		870	85
		ITALSAT	SELENIA	REALIZZAZ.		4,999	86'
					Total:	5,869	
AEROSPATIALE	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		6,748	86'
					Total:	6,748	
AIT	LAGEOS	LAGEOS	AIT	REALIZZAZ.		14,932	85
		LAGEOS	AIT	PROGETTO		587	83
	PROPULS.	IRIS	BPD	PROGETTO PREL.		1,015	80
		IRIS	AIT	PROGETTO		3,823	82
		IRIS	AIT	SVIL.ASE		16,892	84
		IRIS	BPD	SVIL.ISS		2,219	84
		IRIS	BPD	REAL.MOD.ISS		3,955	86'
		IRIS	AIT	REAL.MOD.ASE		47,621	86'
	RIC. TECNOL.	TECN. MECC.	AIT	ANELLO.		101	90
	SAX	SAX	AIT	SISTEMA		568	83
		SAX	AIT	PROGETTO		7,703	86
	STUDI ATT. FUT.	STUDI	AIT	TETHER		57	80
		STUDI	AIT	FATT. SAX		150	81
		STUDI	AIT	STUDI SL		108	81
		STUDI	AIT	ATT. FUT.		57	80
		COLUMBUS	AIT	SISTEMI		147	83
		TETHER AV.	AIT	STUDI		2,712	85
	TELECOM.	ITALSAT	CNS	PROGETTO		1,771	82
		ITALSAT	SELENIA	REALIZZAZ.		5,040	85
		ITALSAT	SELENIA	REALIZZAZ.		7,260	86'
		ITALSAT	SELENIA	SVILUPPO		9,305	84
	TETHER	TETHER	AIT	CORE EQUIP.		592	85
		TETHER	AIT	REALIZZAZ.		38,156	85
		TETHER	AIT	PROGETTO		3,640	81
		TETHER	AIT	BRIDG.PHASE		4,950	84
					Total:	173,361	
AQUATER	OSS. AMBIENT.	TLR	AQUATER	SAR-X		13	81
					Total:	13	
BAE	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		1,200	85
		ITALSAT	SELENIA	REALIZZAZ.		11,585	86'
					Total:	12,785	
BELFOTOP	OSS. AMBIENT.	TLR	BELFOTOP	PR. PILOTA		107	81
					Total:	107	
BPD	PROPULS.	IRIS	AIT	PROGETTO		3,057	82
		IRIS	BPD	SVIL.ISS		14,987	84
		IRIS	BPD	TELEM.		111	83
		IRIS	BPD	PROGETTO PREL.		1,232	80
		IRIS	BPD	REAL.MOD.ISS		27,554	86'

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
	RIC. TECNOL.	PROPULS.	BPD	FATT.PROP.		49	83
	SAX	SAX	AIT	PROGETTO		673	86
	STUDI ATT. FUT.	PROPULSIONE	BPD	PROGETTO		1,875	86
	TELECOM.	ITALSAT	CNS	PROGETTO		1,057	82
		ITALSAT	SELENIA	REALIZZAZ.		7,000	85
		ITALSAT	SELENIA	REALIZZAZ.		18,503	86
		ITALSAT	SELENIA	SVILUPPO		4,663	84
	TETHER	TETHER	AIT	BRIDG.PHASE		359	84
		TETHER	AIT	REALIZZAZ.		5,195	85
					Total:	86,315	
BPD/SEP	LAGEOS	LAGEOS	AIT	REALIZZAZ.		1,426	85
					Total:	1,426	
CENTROTECNICA	RIC. TECNOL.	MICROGR.	UNIVERS.	EURECA		390	85
					Total:	390	
CISE	GESTIONE PSN	CONSULENZE	CISE	CONSULENZE		105	83
	OSS. AMBIENT.	GEODESIA	CISE	LASER MOB.		1,880	86
		TLR	CISE	SAR-X		40	80
		GEODESIA	CISE	LASER MOB.		147	82
	RIC. TECNOL.	TECN. ELETTR.	CISE	SENS. STELL.		130	84
		MICROGR.	CISE	REALIZZAZ.UHV		823	80
		MICROGR.	CISE	MANUTENZ.UHV		50	81
		TECN. MECC.	CISE	CONI FARAL.		100	84
		MICROGR.	CISE	ADES.METALLI		35	84
		TECN. ELETTR.	CISE	SENS. STELL.		990	81
		TLC	ITALTEL	MONOMIC		1,972	81
		TECN. ELETTR.	FIAR	LINEA PILOTA		780	85
		TECN. MECC.	CISE	CELLE SOLARI		700	85
		TECN. ELETTR.	CISE	CELLE GAAS		17	83
		TECN. ELETTR.	CISE	PANN.GAAS		59	83
					Total:	7,829	
CNR	OPERAZIONI	TRAPANI	CNR/PSN	CAMPAGNA		454	84
		TRAPANI	CNR/PSN	CAMPAGNA		442	85
	OSS. AMBIENT.	GEODESIA	CNR	VLBI		30	83
		TLR	CNR	PR. PILOTA		480	85
		TLR	CNR	EMMA-VDS		20	85
		TLR	CNR	PR. PILOTA		71	79
		TLR	CNR	PR. PILOTA		406	80
		TLR	CNR	PR. PILOTA		234	81
		TLR	CNR	PR. PILOTA		403	82
		TLR	CNR	PR. PILOTA		450	83
		TLR	CNR	PR. PILOTA		480	84
	RIC. TECNOL.	TECN. ELETTR.	CNR	PROGRAMMI		15	83
		MICROGR.	CNR	PROGRAMMI		31	84
		TLC	CNR	PROGRAMMI		36	85
		MICROGR.	CNR	PROGRAMMI		55	85
		TLC	CNR	PROGRAMMI		98	84
		TLC	CNR	PROGRAMMI		75	86

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE	COSTO PARZ.	ANNO
		TLC	CNR	PROGRAMMI	166	82
		TLC	CNR	PROGRAMMI	261	83
	SPACE SCIENCE	PAYLOAD SAX	CNR	ESPERIM.	33	86
		PAYLOAD SAX	CNR	SISTEMA	66	83
		PAYLOAD TETHER	CNR	ESPERIM.	423	85
		PAYLOAD SAX	CNR	SISTEMA	1,640	85
		PAYLOAD SAX	CNR	SISTEMA	79	84
		SC. TERRA	CNR	RIC. GEOD.	28	85
		SC. ASTRON.	CNR	ESPERIM.	441	85
		SC. ASTRON.	CNR	ESPERIM. PALL.	1,385	85
		SC. ASTRON.	CNR	GIOTTO	102	85
		SC. ASTRON.	CNR	STAR SENS.	80	84
		SC. ASTRON.	CNR	GIOTTO	17	81
		SC. ASTRON.	CNR	GIOTTO	140	82
		SC. ASTRON.	CNR	GIOTTO	140	83
		SC. ASTRON.	CNR	GIOTTO	89	84
		PAYLOAD TETHER	CNR	ESPERIM.	90	83
		PAYLOAD TETHER	CNR	ESPERIM.	92	84
		SC. ASTRON.	CNR	ESPERIM.	796	79
		SC. ASTRON.	CNR	ESPERIM.	742	80
		SC. ASTRON.	CNR	ESPERIM.	717	81
		SC. ASTRON.	CNR	ESPERIM.	450	82
		SC. ASTRON.	CNR	ESPERIM.	562	83
		SC. ASTRON.	CNR	ESPERIM.	482	84
		SC. ASTRON.	CNR	STAR SENS.	15	81
		SC. ASTRON.	CNR	STAR SENS.	107	82
		SC. ASTRON.	CNR	STAR SENS.	110	83
		SC. ASTRON.	CNR	ESPERIM. PALL.	184	79
		SC. ASTRON.	CNR	ESPERIM. PALL.	401	80
		SC. ASTRON.	CNR	ESPERIM. PALL.	1,578	81
		SC. ASTRON.	CNR	ESPERIM. PALL.	1,382	82
		SC. ASTRON.	CNR	ESPERIM. PALL.	1,840	83
		SC. ASTRON.	CNR	ESPERIM. PALL.	1,648	84
	TELECOM.	SIRIO	CNR	ESPERIM.	156	79
		SIRIO	CNR	ESPERIM.	131	80
				Total:	20,353	
CNR-SEDE	ANTICIPAZ.	CNR	CNR-SEDE	SPESE GENERALI PSN	9,350	86
		CNR	CNR-SEDE	SPESE GENERALI PSN	10,000	85
				Total:	19,350	
CNR/PSN	GESTIONE PSN	PSN	CNR/PSN	GESTIONE	693	81
		PSN	CNR/PSN	GESTIONE	358	80
		PSN	CNR/PSN	GESTIONE	1,367	84
		PSN	CNR/PSN	GESTIONE	1,204	83
		PSN	CNR/PSN	GESTIONE	1,295	82
		PSN	CNR/PSN	GESTIONE	2,022	85
		PSN	CNR/PSN	GESTIONE	2,550	86
	OPERAZIONI	TRAPANI	CNR/PSN	CAMPAGNA	1,628	79
		TRAPANI	CNR/PSN	CAMPAGNA	1,168	81
		TRAPANI	CNR/PSN	CAMPAGNA	1,244	80
		TRAPANI	CNR/PSN	CAMPAGNA	1,047	82
		TRAPANI	CNR/PSN	CAMPAGNA	260	84

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
		TRAPANI	CNR/PSN	CAMPAGNA.		820	83
		TRAPANI	CNR/PSN	CAMPAGNA		490	85
		TRAPANI	CNR/PSN	CAMPAGNA		530	86
					Total:	16,676	
CNS	PROPULS.	IRIS	BPD	PROGETTO PREL.		475	80
	RIC. TECNOL.	TLC	CNS	CLUSTER		172	81
	TELECOM.	ITALSAT	CNS	ATTO AGG.		115	83
		ITALSAT	CNS	PROGETTO		7,820	82
		ITALSAT	TELESPAZIO	CONFIGUR.		1,098	80
					Total:	9,680	
CNUCE	GESTIONE PSN	CONSULENZE	CNUCE	CONSULENZE		105	85
		CONSULENZE	CNUCE	CONSULENZE		45	84
	RIC. TECNOL.	TLC	CNUCE	CONSULENZE		82	83
					Total:	232	
COMDEV	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		900	85
		ITALSAT	SELENIA	REALIZZAZ.		5,198	86
					Total:	6,098	
COMSAT	GESTIONE PSN	CONSULENZE	COMSAT	CONSULENZE		989	85
		CONSULENZE	COMSAT	CONSULENZE		322	81
		CONSULENZE	COMSAT	CONSULENZE		410	82
		CONSULENZE	COMSAT	CONSULENZE		1,241	83
	TELECOM.	ITALSAT	TELESPAZIO	SISTEMA		461	82
					Total:	3,423	
CONTRAVES	OSS. AMBIENT.	TLR	CISE	SAR-X		130	80
	RIC. TECNOL.	TECN. MECC.	CONTRAVES	SISTEMI MECC.		153	85
					Total:	283	
CONTROL SYSTEM	RIC. TECNOL.	MICROGR.	UNIVERS.	EURECA		280	85
					Total:	280	
CSATA	OSS. AMBIENT.	TLR	TELESPAZIO	PR. PILOTA		600	84
		TLR	CSATA	PR. PILOTA		60	81
		TLR	TELESPAZIO	PR. PILOTA		119	81
		TLR	CSATA	PR. PILOTA		165	80
		TLR	TELESPAZIO	PR. PILOTA		153	82
	SPACE SCIENCE	SC. ASTRON.	CSATA	HIPPARCOS		119	84
		SC. ASTRON.	CSATA	HIPPARCOS.		83	83
		SC. ASTRON.	CSATA	HIPPARCOS		404	85

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
					Total:	1,703	
CSELT	TELECOM.	ITALSAT	TELESPAZIO	SISTEMA		431	82
					Total:	431	
CSS	SPACE SCIENCE	SC. ASTRON.	CSS	HIPPARCOS		746	85
		SC. ASTRON.	CSS	HIPPARCOS		181	82
		SC. ASTRON.	CSS	HIPPARCOS		254	83
					Total:	1,181	
CSTS	TELECOM.	ITALSAT	TELESPAZIO	SISTEMA		15	82
					Total:	15	
DIGITAL	OPERAZIONI	MATERA	DIGITAL	OPERAZ.		220	84
					Total:	220	
ELSAG	OSS. AMBIENT.	TLP	TELESPAZIO	EMMA-VDS		2,286	85
					Total:	2,286	
EMS	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		300	85
		ITALSAT	SELENIA	REALIZZAZ.		1,460	86'
					Total:	1,760	
ESA	GESTIONE PSN	CONSULENZE	ESA	CONSULENZE		640	84
		CONSULENZE	ESA	CONSULENZE		632	83
		CONSULENZE	ESA	CONSULENZE		535	82
		CONSULENZE	ESA	CONSULENZE		212	81
		CONSULENZE	ESA	CONSULENZE		2,333	85
					Total:	4,352	
FIAR	PROPULS.	IRIS	AIT	PROGETTO		133	82
		IRIS	AIT	SVIL.ASE		1,636	84
		IRIS	BPD	SVIL.ISS		599	84
		IRIS	BPD	REAL.MOD.ISS		2,174	86'
		IRIS	AIT	REAL.MOD.ASE		1,606	86'
	RIC. TECNOL.	ROBOTICA	FIAR	PROGETTO		76	84
		TECN. ELETTR.	FIAR	LINEA PILOTA		695	85
	SAX	SAX	AIT	PROGETTO		420	86
	STUDI ATT. FUT.	STUDI	FIAR	SIST.ALL.		233	84
	TELECOM.	ITALSAT	CNS	PROGETTO		197	82
		ITALSAT	SELENIA	REALIZZAZ.		3,500	85
		ITALSAT	SELENIA	REALIZZAZ.		17,676	86'
		ITALSAT	SELENIA	SVILUPPO		243	84
	TETHER	TETHER	AIT	BRIDG.PHASE		140	84
		TETHER	AIT	REALIZZAZ.		2,106	85

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
					Total:	31,434	
FIAT	RIC. TECNOL.	PROPULS.	FIAT	ENDOREATT.		135	84
		MICROGR.	FIAT	MANUTENZ.FPM		157	82
		MICROGR.	FIAT	FPM		1,132	80
	STUDI ATT. FUT.	ENDOREATTORE	FIAT	PROGETTO		1,142	86
		TURBO POMPA	FIAT	PROGETTO		358	86
					Total:	2,924	
FOKKER	SAX	SAX	AIT	PROGETTO		268	86
					Total:	268	
FORD	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		280	85
		ITALSAT	SELENIA	REALIZZAZ.		3,007	86'
					Total:	3,287	
FUB	RIC. TECNOL.	TLC	FUB	PROGR. TEL.		85	81
	TELECOM.	SIRIO	FUB	GESTIONE		59	86
					Total:	144	
GALILEO	RIC. TECNOL.	TECN. ELETTR.	GALILEO	SENSORE IR		267	85
	SPACE SCIENCE	SC. ASTRON.	GALILEO	GIOTTO		20	84
		SC. ASTRON.	GALILEO	GIOTTO		7	84
		SC. ASTRON.	GALILEO	GIOTTO		607	82
		SC. ASTRON.	GALILEO	GIOTTO		198	81
	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		4,032	86'
		ITALSAT	SELENIA	SVILUPPO		636	84
					Total:	5,767	
GAVAZZI	OPERAZIONI	TRAPANI	GAVAZZI	STUDI SIST.		59	83
	RIC. TECNOL.	TECN. ELETTR.	CISE	SENS. STELL.		113	84
		TECN. ELETTR.	CISE	SENS. STELL.		340	81
	SPACE SCIENCE	SC. ASTRON.	GAVAZZI	GIOTTO		99	84
		SC. ASTRON.	GAVAZZI	GIOTTO		282	82
		PAYLOAD TETHER	GAVAZZI	ESPERIM.		253	85
		PAYLOAD TETHER	GAVAZZI	ESPERIM.		477	85
		PAYLOAD TETHER	GAVAZZI	ESPERIM.		339	85
					Total:	1,962	
GCE	GESTIONE PSN	CONSULENZE	GCE	CONSULENZE		480	86
		CONSULENZE	GCE	CONSULENZE		210	85
		CONSULENZE	GCE	CONSULENZE		87	83
					Total:	777	
GTE	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		1,680	85

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
					Total:	1,680	
GTE-IFA	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		12.832	86'
					Total:	12,832	
INTA	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		40	85
		ITALSAT	SELENIA	REALIZZAZ.		436	86'
					Total:	476	
ITALTEL	RIC. TECNOL.	TLC	ITALTEL	MONOMIC		1,517	81
					Total:	1,517	
LABEN	LAGEOS	LAGEOS	AIT	REALIZZAZ.		2,231	85
	OPERAZIONI	TRAPANI	LABEN	STUDI SIST.		59	83
		TRAPANI	LABEN	ASSISTENZA		43	82
	PROPULS.	EGSE	LABEN	REALIZZAZ.		4,512	84
		IRIS	BPD	PROGETTO PREL.		465	80
		IRIS	AIT	PROGETTO		814	82
		IRIS	AIT	SVIL.ASE		4,848	84
		IRIS	BPD	SVIL.ISS		4,943	84
		IRIS	BPD	REAL.MOD.ISS		3,479	86'
		IRIS	AIT	REAL.MOD.ASE		5,482	86'
	RIC. TECNOL.	TECN. ELETTR.	CISE	SENS. STELL.		233	84
		TECN. ELETTR.	CISE	SENS. STELL.		1,070	81
		TECN. MECC.	CISE	CELLE SOLARI		441	85
	SAX	SAX	AIT	PROGETTO		618	86
	SPACE SCIENCE	SC. ASTRON.	LABEN	GAMTEL		315	85
		SC. ASTRON.	LABEN	GIOTTO		59	84
		SC. ASTRON.	LABEN	GAMTEL-		140	84
		PAYLOAD SAX	LABEN	STUDIO		289	83
		SC. ASTRON.	LABEN	GAMTEL		451	83
		PAYLOAD SAX	AIT	PROG. P/L		2,875	86
		SC. ASTRON.	LABEN	GIOTTO		450	81
	STUDI ATT. FUT.	EGSE	LABEN	PROGETTO		118	83
	TELECOM.	ITALSAT	CNS	PROGETTO		675	82
		ITALSAT	SELENIA	REALIZZAZ.		1,960	85
		ITALSAT	SELENIA	REALIZZAZ.		7,706	86'
		ITALSAT	SELENIA	SVILUPPO		1,739	84
	TETHER	TETHER	AIT	BRIDG.PHASE		388	84
		TETHER	AIT	REALIZZAZ.		6,010	85
					Total:	52.412	
MATRA	TELECOM.	ITALSAT'	SELENIA	REALIZZAZ.		21.185	86'
		ITALSAT	SELENIA	SVILUPPO		2,354	84
					Total:	23,539	
MATRA/GALILEO	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.		4,500	85

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE	COSTO PARZ.	ANNO
				Total:	4,500	
MEAC	LAGEOS	LAGEOS	AIT	REALIZZAZ.	2.800	85
				Total:	2,800	
MICROTECNICA	LAGEOS	LAGEOS	AIT	REALIZZAZ.	1,236	85
	PROPULS.	IRIS	AIT	PROGETTO	293	82
		IRIS	AIT	SVIL.ASE	4,393	84
		IRIS	AIT	REAL.MOD.ASE	3,876	86'
				Total:	9,798	
MITSUBISHI	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.	340	85
		ITALSAT	SELENIA	REALIZZAZ.	1.659	86'
				Total:	1,999	
NASA	LAGEOS	LAGEOS	NASA	LAND	656	85
	PROPULS.	IRIS	NASA	PRENOTAZIONE	116	79
	SPACE SCIENCE	PAYLOAD TETHER	NASA	PRENOT. TEMAG	206	85
	TELECOM.	ITALSAT	NASA	PRENOT. LAN.	174	82
		ITALSAT	SELENIA	LANCIO STS	6.967	86'
				Total:	5.119	
RIAL	RIC. TECNOL.	MICROGR.	UNIVERS.	EURECA	85	85
				Total:	85	
SAO	OPERAZIONI	MATERA	SAO	CONSUL.	35	84
		MATERA	SAO	INSTALLAZ.	70	83
				Total:	105	
SELENIA	OSS. AMBIENT.	GEODESIA	SELENIA	VLBI	6,825	86'
		TLR	SELENIA	SAR-X	1,596	85
		TLR	SELENIA	SAR-X	592	84
		GEODESIA	SELENIA	VLBI	937	84
		TLR	CISE	SAR-X	142	80
	PROPULS.	IRIS	BPD	PROGETTO PREL.	172	80
	RIC. TECNOL.	ROBOTICA	SELENIA	PROGETTO	72	85
		TLC	ITALTEL	MONOMIC	1,008	81
	SAX	SAX	AIT	PROGETTO	302	86
	STUDI ATT. FUT.	STUDI	SELENIA	RADIOM. MICR.	143	85
	TELECOM.	ITALSAT	SELENIA	ATTO AGG.	418	85
		ITALSAT	SELENIA	REALIZZAZ.	41,721	85
		ITALSAT	CNS	PROGETTO	4,746	82
		ITALSAT	SELENIA	SVILUPPO	17,517	84
		ITALSAT	TELESPAZIO	CONFIGUR.	552	80
		ITALSAT	TELESPAZIO	SISTEMA	1,600	82
		SIRIO	SELENIA	VERTENZA	340	85
		ITALSAT	SELENIA	REALIZZAZ.	129,616	86'
	TETHER	TETHER	AIT	BRIDG.PHASE	88	84

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE	COSTO PARZ.	ANNO
		TETHER	AIT	REALIZZAZ.	2,533	85
				Total:	210,920	
SMA	OSS. AMBIENT.	TLR	CISE	SAR-X	40	80
				Total:	40	
SNIAS	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.	460	85
				Total:	460	
TELESPAZIO	GESTIONE PSN	CONSULENZE	TELESPAZIO	CONSULENZE	1,140	86
	OPERAZIONI	MATERA	TELESPAZIO	OPERAZ.	3,897	85
		MATERA	TELESPAZIO	INSTALLAZ.	818	83
		MATERA	TELESPAZIO	OPERAZ.	2,278	83
	OSS. AMBIENT.	TLR	TELESPAZIO	PR. PILOTA	729	84
		TLR	TELESPAZIO	EMMA-VDS	849	84
		GEODESIA	TELESPAZIO	VLBI	150	81
		TLR	TELESPAZIO	PR. PILOTA	255	81
		TLR	TELESPAZIO	PR. PILOTA	152	81
		TLR	TELESPAZIO	PR. PILOTA	492	82
		TLR	TELESPAZIO	EMMA-VDS	50	82
		TLR	TELESPAZIO	EMMA-VDS	2,594	85
	RIC. TECNOL.	TLC	TELESPAZIO	COLLEG. ITALSAT-ACTS	90	86
		TLC	TELESPAZIO	MONOPULSE	27	81
		TLC	TELESPAZIO	PROP.UNIF.	60	81
	SAX	SAX	AIT	PROGETTO	138	86
		GROUND A B	TELESPAZIO	SEGMENTO TERRA	1,932	86
	SPACE SCIENCE	SC. TERRA	TELESPAZIO	MOTO DEL POLO	93	86
		SC. TERRA	TELESPAZIO	MOTO DEL POLO	67	83
	TELECOM.	OLYMPUS	TELESPAZIO	STUDIO	105	86
		ITALSAT	TELESPAZIO	GEST.ORB.	727	84
		SIRIO	TELESPAZIO	GESTIONE	2,786	81
		ITALSAT	TELESPAZIO	SERV.SPEC.	77	81
		ITALSAT	TELESPAZIO	CONSULENZE	92	81
		ITALSAT	TELESPAZIO	SISTEMA	3,209	82
		ITALSAT	TELESPAZIO	CONFIGUR.	847	80
		SIRIO	TELESPAZIO	GESTIONE	49	86
		SIRIO.	TELESPAZIO	GESTIONE	2,000	82
				Total:	25,923	
TRANSCO	TELECOM.	ITALSAT	SELENIA	REALIZZAZ.	310	85
		ITALSAT	SELENIA	REALIZZAZ.	1,658	86
				Total:	1,968	
UNIV.ROMA	ANTICIPAZ.	S.MARCO	UNIV.ROMA	OPERAZ.	5,400	86
	OPERAZIONI	S.MARCO	UNIV.ROMA	OPERAZ.	17,000	82
		S.MARCO	UNIV.ROMA	OPERAZ.	3,000	79

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE	COSTO PARZ.	ANNO
				Total:	25.400	
UNIVERS.	OSS. AMBIENT.	GEODESIA	UNIVERS.	VLBI	182	83
		TLR	UNIVERS.	PR. PILOTA	320	85
		TLR	UNIVERS.	EMMA-VDS	10	85
		TLR	UNIVERS.	PR. PILOTA	315	84
		TLR	UNIVERS.	PR. PILOTA	303	83
		TLR	UNIVERS.	PR. PILOTA	463	82
		TLR	UNIVERS.	PR. PILOTA	65	81
		TLR	UNIVERS.	PR. PILOTA	527	80
		TLR	UNIVERS.	PR. PILOTA	470	79
		GEODESIA	UNIVERS.	VLBI	25	82
	RIC. TECNOL.	TLC	UNIVERS.	PROGRAMMI	216	83
		MICROGR.	UNIVERS.	PROGRAMMI	130	83
		TECN. MECC.	UNIVERS.	PROGRAMMI	95	83
		MICROGR.	UNIVERS.	PROGRAMMI	294	84
		TECN. ELETTR.	UNIVERS.	PROGRAMMI	30	85
		MICROGR.	UNIVERS.	PROGRAMMI	150	82
		MICROGR.	UNIVERS.	PROGRAMMI	40	85
		MICROGR.	UNIVERS.	EURECA	325	85
		TECN. ELETTR.	UNIVERS.	PROGRAMMI	14	84
		TECN. ELETTR.	UNIVERS.	PROGRAMMI	27	83
		TECN. ELETTR.	UNIVERS.	PROGRAMMI	297	82
		TLC	UNIVERS.	PROGRAMMI	181	81
		MICROGR.	UNIVERS.	PROGRAMMI	125	80
	SPACE SCIENCE	SC. ASTRON.	UNIVERS.	ESPERIM.	55	86
		PAYLOAD SAX	UNIVERS.	SISTEMA	523	84
		PAYLOAD TETHER	UNIVERS.	ESPERIM.	170	85
		SC. ASTRON.	UNIVERS.	ESPERIM.	636	85
		PAYLOAD SAX	UNIVERS.	SISTEMA	196	85
		SC. TERRA	UNIVERS.	RIC. GEOD.	285	85
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.	212	85
		SC. ASTRON.	UNIVERS.	GIOTTO	100	85
		SC. ASTRON.	UNIVERS.	HIPPARCOS	137	84
		SC. VITA	UNIVERS.	ESPERIM.	439	85
		SC. ASTRON.	UNIVERS.	GIOTTO	105	81
		SC. ASTRON.	UNIVERS.	GIOTTO	61	82
		SC. ASTRON.	UNIVERS.	GIOTTO	60	83
		SC. ASTRON.	UNIVERS.	GIOTTO	112	84
		SC. ASTRON.	UNIVERS.	HIPPARCOS	20	80
		SC. ASTRON.	UNIVERS.	HIPPARCOS	32	81
		SC. ASTRON.	UNIVERS.	HIPPARCOS	130	82
		SC. ASTRON.	UNIVERS.	HIPPARCOS	109	83
		PAYLOAD TETHER	UNIVERS.	ESPERIM.	8	83
		PAYLOAD TETHER	UNIVERS.	ESPERIM.	56	84
		PAYLOAD SAX	UNIVERS.	SISTEMA	9	83
		SC. TERRA	UNIVERS.	RIC. GEOD.	190	84
		SC. ASTRON.	UNIVERS.	ESPERIM.	256	79
		SC. ASTRON.	UNIVERS.	ESPERIM.	840	80
		SC. ASTRON.	UNIVERS.	ESPERIM.	766	81
		SC. ASTRON.	UNIVERS.	ESPERIM.	801	82
		SC. ASTRON.	UNIVERS.	ESPERIM.	870	83
		SC. ASTRON.	UNIVERS.	ESPERIM.	621	84
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.	29	79

FINANZIAMENTI PSN

SUB/CONTR.	PROGRAMMA	PROGETTO	PRIME/CONTR.	DESCRIZIONE		COSTO PARZ.	ANNO
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.		159	80
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.		116	81
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.		202	82
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.		309	83
		SC. ASTRON.	UNIVERS.	ESPERIM. PALL.		133	84
		SC. VITA	UNIVERS.	ESPERIM.		141	79
		SC. VITA	UNIVERS.	ESPERIM.		108	80
		SC. VITA	UNIVERS.	ESPERIM.		54	81
		SC. VITA	UNIVERS.	ESPERIM.		53	82
		SC. VITA	UNIVERS.	ESPERIM.		137	83
		SC. VITA	UNIVERS.	ESPERIM.		343	84
	STUDI ATT. FUT.	STUDI	UNIVERS.	STAZ. SPAZ.		39	81
		STUDI	UNIVERS.	STAZ. SPAZ.		60	86
	TELECOM.	SIRIO	UNIVERS.	ESPERIM.		231	80
					Total:	14,521	
VDS	OSS. AMBIENT.	TLR	VDS	EMMA-VDS		842	84
					Total:	842	
VARDNEY	LAGEOS	LAGEOS	AIT	REALIZZAZ.		359	85
					Total:	359	
ZODIAC	OPERAZIONI	TRAPANI	ZODIAC	PALLONE		80	86
					Total:	80	
ZYSC	LAGEOS	LAGEOS	AIT	REALIZZAZ.		1,158	85
					Total:	1,158	
					Total:	831,261	

Key:

1. PSN [National Space Plan] Financing
2. Program
3. Project
4. Description
5. Prime contract
6. Sub/contract
7. Partial cost
8. Commitment
9. Year
10. Provision
11. PSN General expenditures
12. CNR [Nuclear Research Center] Headquarters
13. Operation
14. PSN Management
15. Consulting
16. Development
17. Installation
18. Systems studies
19. Campaign
20. Assistance
21. Balloon
22. Environment
23. Pilot project
24. Propeller
25. Reservation
26. Preliminary project
27. Technological research
28. Robotics
29. Electronic technology
30. Star sensor
31. Pilot line
32. Gaas cells
33. Gaas panels
34. Mechanical technology
35. Hood cones
36. Ring
37. Solar cells
38. Italsat-Acts connection
39. Ground segment
40. System
41. Experiment
42. Study
43. Astronomy science
44. Earth science
45. Life science

46. Present and future studies
47. Orbital management
48. Configuration
49. Special service
50. STS launching

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CSO: 3698/M072

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